25X1

CORONA PROGRAM HISTORY

VOLUME I

PROGRAM OVERVIEW

19 May 1976

This volume consists of 90 pages.

Volume I of V Volumes

Copy 7 of 12 Copies

CORONA HISTORY
Volume I

FOREWORD

Throughout the past fourteen years, earth satellite reconnaissance, particularly imagery reconnaissance has provided strategic intelligence at each key juncture in international affairs. This includes from exposure of the "missile gap myth" to the current verification of the Strategic Arms Limitation (SALT) Agreements. It was primarily through our reconnaissance intelligence technology that we were able to monitor and answer these types of vital questions to our national security. Without this independent means of obtaining continued, reliable, and hard intelligence, the course of history would likely have been quite different.

Although this series of reports entitled "CORONA Program History" was prepared and compiled by the Central Intelligence Agency (CIA), it received textual input, illustrations, and supportive data from the many contractors and government agencies who combined to make the CORONA Program a success. In particular as CORONA was the pioneer and the first of our earth satellite photographic reconnaissance systems, it is important that the story of this program and its contributions be written and preserved for the day it can be released to the general public.

This version of the history of CORONA has been written as a memoir of the views of the Central Intelligence Agency and their role and interaction with the organizations involved in this program. Of special significance was the association and knowledge between CIA and the different staff and working levels of the Executive Branch, the National Reconnaissance Office (NRO), Department of Defense (DoD), United States Air Force (USAF), Advanced Research Projects Agency (ARPA), and the main contractors which include 25X1
Lockheed Missile and Space Center (LMSC), Aerospace Corporation, Fairchild Camera and Instrument Corporation (FCIC), General Electric (GE), Itek, [redacted]
25X1 NRO [redacted] and Douglas Aircraft. The "CORONA Program History" has been produced in five volumes. The first volume is a summarization of CORONA. The remaining four volumes present a more qualitative account of the key phases outlined in Volume I. More specifically, Volume I provides an overview of the CORONA Program based upon the recollections of key CIA people; Volume II presents greater detail regarding governmental activities; Volume III discusses the camera systems and contractors; Volume IV addresses recovery and recovery system contractors; and Volume V summarizes vehicle integration and the major role of the satellite vehicle integration contractor (SVIC).

The context of this series of reports is a consolidation of miscellaneous pieces of data, memos, letters, and results of personal interviews which have been resurrected and, therefore, are no longer part of any single official file within the National Reconnaissance Program.

25X1

Several factors have been excluded from this history, as the primary purpose was to present the story of the evolution of the different subsystems involved in CORONA operations during its fourteen years of development and service. Although some of these are briefly mentioned or referenced, there is no detailed discussions on the exploitation results on a mission-by-mission basis; specialized target requirements (color/infrared/black and white, stereo/mono, coverage frequency, etc.); independent photointerpretation quality studies after each system modification (change in film type, use of interchangeable filters, varying exposures on-orbit, improved optics, etc.); reproduction of material and dissemination to user community to include equipment, personnel, volume, cost, response time, different photo-chemistry and film combination problems, faster processing techniques, quality control through automated and manual means; logistics to include transportation, security, funding, coordination support, vehicles, etc; and documentation through mission evaluation reports and studies. However, much of this information is available at the facilities tasked with the responsibility for that particular phase of the mission. The photographic reproduction of the CORONA product was assigned to the Hawkeye (black and white) and Lincoln (color) Plants at Eastman Kodak and at the Air Force Special Projects Production Facility, Westover Air Force Base. "Processing and Duplication Reports of the Original Camera Record" of each mission segment were produced by Eastman Kodak. These reports present the processing history of the original film; technical mission data; physical condition status of original film when shipped; production data; and miscellaneous information pertinent to that specific mission.

The exploitation responsibilities were directed to the National Photographic Interpretation Center (NPIC), Washington, D.C. Two CORONA achievements come immediately to mind when discussing the impact and significance of this program. The first was the recovery of the first photo reconnaissance product from DISCOVERER XIV on 19 August 1960. From this film, photointerpreters were able to show that the Soviets did not have numerous Intercontinental Ballistic Missiles (ICBMs) emplace and pointed toward the United States. In effect this intelligence ended the high-level concern over the conjecture of the existence of any "missile gap." The second was the coverage provided by CORONA which photographically confirmed the claims of destruction to the Arabs by the Israelis in the Middle East crisis (Six-day War) of 1967. In the photo-intelligence area, the following exploitation and mission summary information is presently available at the NPIC Information Library: Mission Plots; Performance Evaluation Reports (PERs) and Technical Evaluation Reports (TEROs) prepared by the Program Office and the Air Force; the Exploitation Product File (EPF) which lists the third phase intelligence reports on all targets covered by CORONA; the Installation Data File (IDF) which lists the history of the coverage over each targeted installation; and the OAK Reports which give the

25X1

intelligence readout data on specific priority target requirements for a given mission. Most data and documentation prior to 1970 are in hard back form, while the results of earlier missions have been transposed to a microfiche filing system. The original negative from CORONA missions is stored in a respository located in the Washington D.C. area.

The "CORONA Program History" is dedicated to the men and women in the Government (military and civilian) and in private industry who made this program a success through individual and collective achievements in design; engineering; launch, flight, and recovery operations; imagery processing and duplication; system performance evaluation; and intelligence analysis.

Although many credits are due for compiling, organizing, and reproducing this history, the following are deserving of special recognition for their significant contributions:

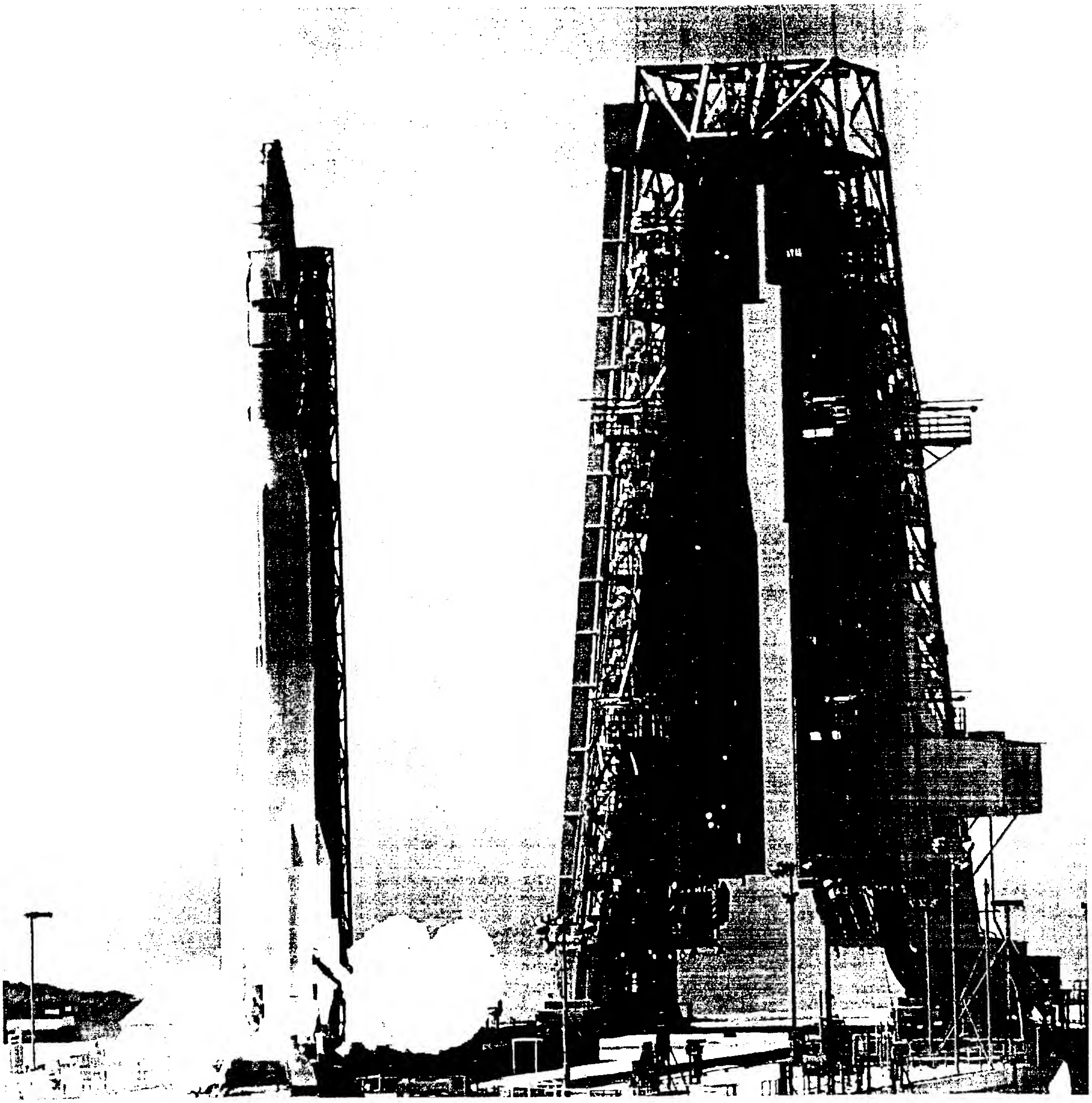
Volume I	Kenneth Greer
Volume II	Helen Kleyla
Volume III	Harold Alpaugh/Maurice Burnett
Volume IV	John Baker/Charles Leonard
Volume V	William Orton/Kenneth Perryman

A special credit is due to the US Air Force Special Projects Production Facility (AFSPPF) and particularly Colonels H. Duval and V. Stanley for assistance in the publication of this historic record.

25X1

[redacted]

CORONA, THE FIRST EARTH SATELLITE PHOTOGRAPHIC RECONNAISSANCE SYSTEM



25X1

TOP SECRET

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

PUBLICATION REVIEW

This report has been reviewed and is approved.

25X1 [redacted]

A. ROY BURKS
CORONA Project Officer
Directorate of Science & Technology
Central Intelligence Agency

25X1 [redacted]

TABLE OF CONTENTS

DISTRIBUTION

Organization	For Attention of	Copy Number
NRO	- J. Plummer	2
SAFSP	- Gen Kulpa	1
CIA/S&T	- C. Duckett	1
CIA/Archives	-	1
CIA/OD&E	- L. Dirks	1
CIA/Project Officer	- R. Burks	2
NPIC	- J. Hicks	1
ITEK	- J. Wolfe	1
GE	- M. Morton	1
LMSC	- Q. Riepe	1

SECTION I

BACKGROUND

The contribution of the CORONA reconnaissance system is best understood in the light of earlier history of reconnaissance programs. The U-2, which began operating in the fall of 1956, was expected to have a relatively short operational life in overflying the Soviet Union, perhaps no more than a year or two. That expectation was based less on the likelihood of the Soviets perfecting a means of shooting it down than on a pessimistic estimate of their ability to develop a radar surveillance network capable of reliably tracking the U-2. With accurate tracking data in hand, the Soviets could file diplomatic protests with enough supportive evidence to lead to political pressures to discontinue the overflights. As it turned out, the United States had misjudged the performance characteristics and deployment pattern of the Soviet air surveillance network. Their radar promptly acquired and continuously tracked the very first U-2 flight over Soviet territory. The Soviets filed a formal protest within days of the incident; however, operations were resumed after a temporary standdown.

For nearly four years, the U-2 ranged over much of the world, although only sporadically over the Soviet Union. The effectiveness of the Soviet radar network was such that each flight risked another protest and another standdown. Clearly, some means had to be found for accelerating the development of a less vulnerable reconnaissance system to succeed the U-2. Fortunately, by the time Francis Gary Powers was shot down near Sverdlovsk on 1 May 1960, an alternative means of carrying out photographic reconnaissance over the Soviet Union was approaching operational readiness. On 19 August 1960, just 110 days after the downing of the last U-2 engaged in overflight of the Soviet Union, the first successful air catch was made near Hawaii of a capsule of exposed film ejected from a photographic reconnaissance satellite that had completed seven passes over denied territory and 17 orbits of the earth. The feat was the culmination of three years of intensive effort to obtain intelligence from an imagery reconnaissance satellite.

At about the time the U-2 first began overflying the Soviet Union in 1956, the United States Air Force was embarking on the development of strategic reconnaissance systems employing orbiting satellites in a variety of collection configurations. The program, which was designated WS-117L, had its origins in 1946 when a requirement was placed on the RAND Corporation for a study of the technical feasibility of orbiting artificial satellites. The first real breakthrough had come in 1953 when the USAF Scientific Advisory Board reported to the Air Staff that it was feasible to produce relatively small and lightweight thermonuclear warheads. As a result of that report, the ATLAS ICBM Program was accorded the highest priority in the Air Force.

25X1

Since the propulsion required to place a satellite in orbit is of the same general order of magnitude as that required to launch an ICBM, the achievement of this level of propulsion made it possible to begin thinking seriously of launching orbital satellites. General Operational Requirement No. 80 was levied in 1955 with the stated objective of providing continuous surveillance of preselected areas of the world to determine a potential enemy's war-making capability.

In 1956, the Air Research and Development Command, which had inherited the RAND study program (Project Feedback) in 1953, assigned the satellite project to its Ballistic Missile Division. The development plan for WS-117L was approved in July 1956. The program got under way in October 1956 with the awarding of a contract to the Lockheed Aircraft Corporation for the development and testing of the system under their program name PIED PIPER.

The planning for WS-117L contemplated a family of separate systems and subsystems employing satellites for the collection of photographic, electronic, and infrared intelligence. The program, which was scheduled to extend beyond 1965, was divided into three phases. Phase I, the THOR-boosted test series, was to begin in November 1958 and had a primary objective of development/initial testing. Phase II, the ATLAS-boosted test series, was scheduled to begin in June 1959 with the objective of completing the transition from the testing phase to the operational phase and of proving the capability of the ATLAS booster to launch heavy loads into space. Phase III, the operational series, was to begin in March 1960 and was to consist of three progressively more sophisticated systems: the Pioneer version (photographic and electronic), the Advanced version (photographic and electronic), and the Surveillance version (photographic, electronic, and infrared). It was expected that operational control of WS-117L would be transferred to the Strategic Air Command with the initiation of Phase III.

It was an ambitious and complex program that was pioneering in technical fields about which little was known. The program suffered greatly from insufficient funding, and not surprisingly, it had become apparent by the end of 1957 that the program was running behind. It also was in trouble from the standpoint of security. The U-2 program was carried out in secret from 1956 until May 1960, except from the Soviet Government of course. The Soviets, however, chose to allow the program to remain a secret from the general public (and from most of the official community) in preference to publicizing its existence and thereby admitting that they lacked the means of defending their air space against the high flying U-2. WS-117L was undertaken as a classified project, although its existence was not concealed. All findings were reported to and approved by Congress. The press soon began publishing stories on the nature of the program, correctly identifying it as involving military reconnaissance satellites, and referring to it as "Big Brother" and "Spy in the Sky." The publicity was of concern because the development of WS-117L was 25X1
begun in a period when the international political climate was hostile to any form of overflight reconnaissance.

After the successful launch of SPUTNIK I on 4 October 1957, and the initiation by the Senate Preparedness Subcommittee of an investigation into the United States "missile lag," there was pressure from all quarters to accelerate the United States missile and space program and also much public discussion of civilian versus military control of the space program.

It was against this background that the President's Board of Consultants on Foreign Intelligence Activities submitted its semi-annual report to the President on 24 October 1957. The Board noted in its report that it was aware of two advanced reconnaissance systems that were under consideration. One was a study then in progress in the Central Intelligence Agency concerning the feasibility of a manned reconnaissance aircraft designed for greatly increased performance and reduced radar cross-section; the other was WS-117L which at that time included the concept, approach, and much of the technology later used in CORONA. This had been developed from July - September 1957 at BMD by General Schriever and others. However, there appeared to be little likelihood that either of these could produce operational systems earlier than mid-1959 unless increased funding was provided and decisive management actions were taken. The Board emphasized the need for an interim photo reconnaissance system and recommended that an early review be made of new developments in advanced reconnaissance systems to insure that they were given adequate consideration and received proper funding and management in the light of pressing intelligence requirements. The Executive Secretary of the National Security Council on 28 October notified the Secretary of Defense and the Director of Central Intelligence (DCI) that the President had asked for a joint report from them on the status of the advanced systems. The Deputy Secretary of Defense, Donald Quarles responded on behalf of himself and Mr. Allen Dulles on 5 December with a recommendation that because of the extreme sensitivity of the subject, details on the new systems be furnished through oral briefings.

As a consequence of that proposal, there are few official records in the Project CORONA files bearing dates between 5 December 1957 and 28 February 1958. It is clear, however, that major decisions were made and that important actions were undertaken during the period. In brief, it was decided that those portions of WS-117L, offering the best prospect of early success would be separated from WS-117L. This would be designated as CORONA and placed under a joint CIA-Air Force management team, an approach that had been so successful in covertly developing and operating the U-2. Air Force management, particularly Major General B. A. Schriever, the Commander of the Western Development Division, and Col Fritz C. Oder, the Program Director for WS-117L, contributed greatly to the CORONA decisions in this time frame as did Dr. Edwin Land of Polaroid Corporation, Dr. James A. Killian, the Special Assistant to the President for Science and Technology, and Brigadier General A. J. Goodpaster, the President's Staff Secretary at the White House.

The nucleus of a team was constituted as the Development Projects Staff under the direction of Richard Bissell, who was Special Assistant to the DCI for Plans and Development. Bissell was designated as the 25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

senior CIA representative on the new venture; and his Air Force counterpart was Brigadier General Osmund Ritland, who, as Colonel Ritland, had served as Bissell's first deputy in the early days of the Development Projects Staff and was then Vice Commander of the Air Force Ballistic Missile Division.

Bissell recalls that he first learned of the role intended for him "in an odd and informal way" from Dr. Edwin Land, with whom he had worked on the development of the U-2 reconnaissance system and who had come to head a panel of technical consultants informally known as the Land Panel. Bissell also recalls that his early instructions were extremely vague: that the subsystem was to be developed out of work accomplished under WS-117L, that it was to be placed under separate covert management, and that the pattern established for the development of the U-2 was to be followed. Figure 1-1 shows Mr. Bissell and General Ritland, the organizers of Project CORONA.

25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

THE ORGANIZERS OF CORONA

Richard Bissell (left) and Osmund Ritland (right)

Figure 1-1

SECTION II

THE EARLY ORGANIZATIONAL PERIOD

Roughly concurrent with the decision to place one of the WS-117L subsystems under covert management, the Department of Defense realigned its structure for the management of space activities. The Advanced Research Projects Agency (ARPA) was established on 8 February 1958 and was granted authority over all military space projects. The splitting off of CORONA from WS-117L was accomplished by an ARPA directive of 28 February 1958 assigning responsibility for the WS-117L program to the Air Force and ordering that the proposed WS-117L interim reconnaissance system employing THOR boosters be dropped.

The ARPA directive ostensibly cancelling the THOR-boosted interim reconnaissance satellite was followed by all of the notifications that would normally accompany the cancellation of a military program. The word was passed officially within the Air Force, and formal contract cancellations were sent out to the prospective suppliers. Contractors were furious over the suddenness of the action, and Air Force personnel were thunderstruck at the abandonment of the WS-117L photographic subsystem which seemed to have the best chance of early success. Subsequent to the cancellation, only a very limited number of individuals in the Air Force and participating companies were cleared for Project CORONA. These people were informed of the procedures to be followed in the covert reactivation of the cancelled program.

Although CORONA was removed from WS-117L and placed under separate management as a covert activity, the original intent was to disguise its real purpose by concealing it as an experimental program carrying the name, DISCOVERER. DISCOVERER was represented as a scientific program whose findings would be of value to many related programs. This permitted overt procurement of the necessary boosters, second stages, and hardware associated with the biomedical cover launches. It also provided an explanation for the construction of launch and ground control facilities. Only the program components associated with the true photographic reconnaissance mission had to be procured covertly.

After Bissell and Ritland had worked out the arrangements for the overt cancellation and covert reactivation of the program, they began to address the technical problems associated with the design configuration they had inherited from WS-117L. The subsystem contemplated the use of the THOR IRBM as the first stage booster and, as a second stage, a Lockheed-modified satellite vehicle or spacecraft that had been designed around the Bell Aircraft engine developed for the B-58 HUSTLER Bomber. It carried the HUSTLER designation during the development phase of WS-117L but soon came to be known as the AGENA, the name it bears today.

25X1

Several important design decisions were implemented in this organizational period of CORONA. Recognizing the need for resolution to meet the intelligence objectives, it was concluded that the previously developed concept of physical film recovery did indeed offer the most promising approach for a usable photographic return in the interim time period and should be pursued. This resulted in the design of a recovery pod or capsule with General Electric selected as the recovery vehicle contractor. The decision to pursue film recovery proved in retrospect to be one of the most important made in United States reconnaissance activities. History shows that the crucial decade of the 1960's intelligence needs could not have been served by the state-of-the-art in readout technology--the alternative concept developed under WS-117L. It should also be noted that both the manned and unmanned United States space recovery programs which followed have leaned very heavily on the re-entry technology developed for CORONA.

Other major decisions for the new CORONA Program resulted from a three-day conference in San Mateo, California, among representatives of CIA, Air Force Ballistic Missile Division, Lockheed, General Electric, and Fairchild. Discussion at the San Mateo meeting got into the need for immediate contractual arrangements with the various suppliers. Bissell remarked that he was "faced with the problem at present of being broke" and would need estimates from all of the suppliers as soon as possible in order to obtain the necessary financing to get the program under way. The suppliers agreed to furnish the required estimates by the following week. However following that meeting, the project quickly began taking formal shape. Within a span of about three weeks, approval of the program and of its financing was obtained, and the design of the payload configuration evolved. It was at this point in late March and early April that lengthy and serious consideration of different camera and spacecraft configurations proposed by Fairchild Camera and Instrument Company (FCIC) and Itek Corporation was culminated. Interest shifted toward the design submitted by the Itek Corporation (primarily formed from resources of Boston University). Itek proposed a longer focal length camera which would scan within an earth center stabilized pod. This concept promised substantially better ground resolution performance. The Itek design was based on the principles of the BU HYAC High Acuity, Panoramic Camera. Bissell recalls that he personally decided in favor of the Itek design, but only after much agonizing evaluation. The decision was a difficult one to make because it involved moving from the previously intended method of space vehicle stabilization to one that was technically more difficult to accomplish. It did, however, standardize on the three-axis stabilization which was being pursued in the WS-117L AGENA development and which has been a part of all subsequent photo reconnaissance systems.

25X1

Bissell's first project proposal, which was completed on 9 April 1958, requested approval for concurrent development of both the Fairchild and the Itek systems, with the Fairchild configuration becoming operational first and the Itek configuration being developed as a follow-on system. Within two days, however, Bissell made the final decision to abandon the Fairchild spin-stabilized configuration entirely. He rewrote the project proposal taking note of the earlier configuration and giving his reasons for favoring the Itek approach which principally were: the better resolution attainable, the lower overall cost, and the greater potential for growth. The proposal was rewritten a second time, retaining the Itek configuration but raising the cost estimate [redacted] Of the total estimated cost, [redacted] represented "a rather arbitrary allowance" for 12 THOR boosters and Lockheed second stage vehicles and was to be financed by ARPA through the Air Force. The remaining $7 million was for covert procurement by CIA of the pods containing the reconnaissance equipment and the recoverable film cassettes.

The final project proposal was forwarded to Brigadier General Andrew J. Goodpaster, the President's Staff Secretary, on 16 April 1958 after having been reviewed by Mr. Roy Johnson and Admiral John Clark of ARPA; Mr. Richard Horner, Assistant Secretary of the Air Force for Research and Development; Brigadier General Osmund Ritland, Vice Commander, Air Force Ballistic Missile Division; and Dr. James Killian, Special Assistant to the President for Science and Technology. The proposal was approved, although not in writing. The only original record of the President's approval reportedly was in the form of a handwritten note on the back of an envelope by General Cabell, then Deputy Director of Central Intelligence.

Although it may have been the original intent that CORONA would be administered in a manner essentially the same as that of the U-2 program, it actually began and evolved quite differently. It was a joint CIA-ARPA-Air Force effort, much as the U-2 was a joint CIA-Air Force effort, but it lacked the central direction that characterized the U-2 program. The project proposal described the anticipated administrative arrangements, but it fell short of clarifying the delineation of authorities. It noted that CORONA was being carried out under the authority of ARPA and CIA with the support and participation of the Air Force. CIA's role was further explained in terms of participating in supervision of the technical development, especially with regards to the actual reconnaissance equipment, handling all covert procurement, and maintenance of cover and security. The work statement prepared for Lockheed, the prime contractor, on 25 April 1958 noted merely that technical direction of the program was the joint responsibility of several agencies of the Government.

The imprecise statements of who was to do what in connection with CORONA allowed for a range of interpretations. The vague assignments of responsibilities caused no appreciable difficulties in the early years of CORONA when the organization was small and the joint concern was primarily with producing as promised, but they later (1963-1965) became a source of friction between CIA and the Air Force.

[redacted]

Bissell gave this description of how the program was initially managed:

> "The program was started in a marvelously informal manner. Ritland and I worked out the division of labor between the two organizations as we went along. Decisions were made jointly. There were so few people involved and their relations were so close that decisions could be and were made quickly and cleanly. We did not have the problem of having to make compromises or of endless delays awaiting agreement. After we got fully organized and the contracts had been let, we began a system of management through monthly suppliers' meetings--as we had done with the U-2. Ritland and I sat at the end of the table, and I acted as chairman. The group included two or three people from each of the suppliers. We heard reports of progress and ventilated problems--especially those involving interfaces among contractors. The program was handled in an extraordinarily cooperative manner between the Air Force and CIA. Almost all of the people involved on the Government side were more interested in getting the job done than in claiming credit or gaining control."

The schedule of the program, as it had been presented to the CORONA group at its meeting in San Mateo in late March 1958, called for a "count-down" beginning about the first of July 1958 and extending for a period of 19 weeks. It was anticipated that the equipment would be assembled, tested, and the first vehicle launched during that 19-week period, which meant that the fabrication of the individual components would have had to be completed by 1 July. By the time Bissell submitted his project proposal some three weeks later, it had become apparent that the earlier scheduling was unrealistic. Bissell noted in his project proposal that it was not yet possible to establish a firm schedule of delivery dates, but that it appeared probable that the first firing could be attempted no later than June 1959.

It is pertinent to note here that there was no expectation in 1958 that CORONA would still be operating over a decade later. The CORONA Program got under way initially as an interim, short-term, relatively low-risk development to meet the intelligence community's requirements for area search photographic reconnaissance pending successful development of other more sophisticated systems planned for WS-117L. The original CORONA proposal anticipated the acquisition of only 12 vehicles, noting that at a later date it might be desirable to consider whether the program should be extended, with or without further technological improvement.

Having settled on the desired configuration and having received Presidential approval of the program and its financing, the CORONA management team moved forward rapidly with the contractual arrangements. The team of contractors for CORONA differed from the team on the WS-117L as a consequence of selecting Itek's panoramic camera and the film recovery approach. Itek was brought in as one of the two major sub-contractors to Lockheed (General Electric being the other). However, to soften the financial blow to Fairchild, Itek was made responsible for the design and development of the camera subsystem with Fairchild producing the camera under subcontract to Itek. This contractor team continued throughout the CORONA Program, although in 1961 the relationship was changed as a cost savings measure to the Government to that of

25X1

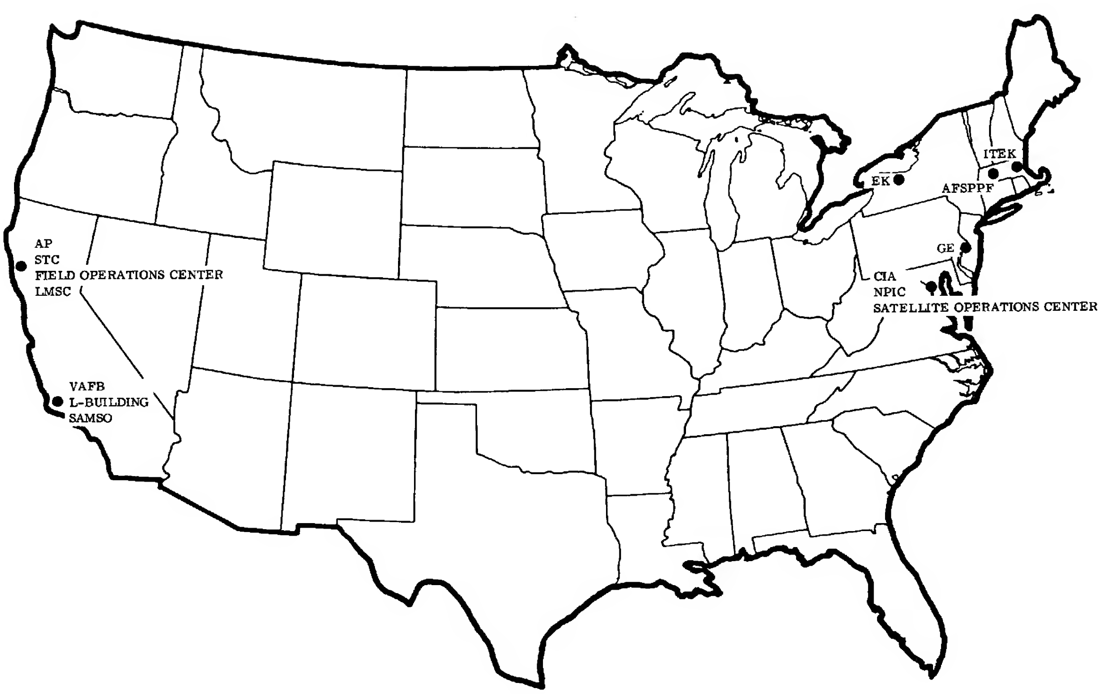
Associate Contractors. The contractor relationships on the CORONA Program were as friendly and cooperative as any that could have been set up, and this team dedication to this program is one of the primary reasons for the overall success which the program enjoyed. The locations of the Contractor and Government facilities are shown in Figure 2-1. The final contractors were selected on 25 April, and a work statement was issued to Lockheed on that date. The contractors began systems design on 28 April and submitted them for first review on 14 May. The designs were frozen on 26 July 1958.

25X1

Figure 2-1

LOCATIONS OF GOVERNMENT AND CONTRACTOR FACILITIES

SUPPORTING CORONA



TOP SECRET

25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

THE ORIGINAL FACILITY FOR CORONA FABRICATION

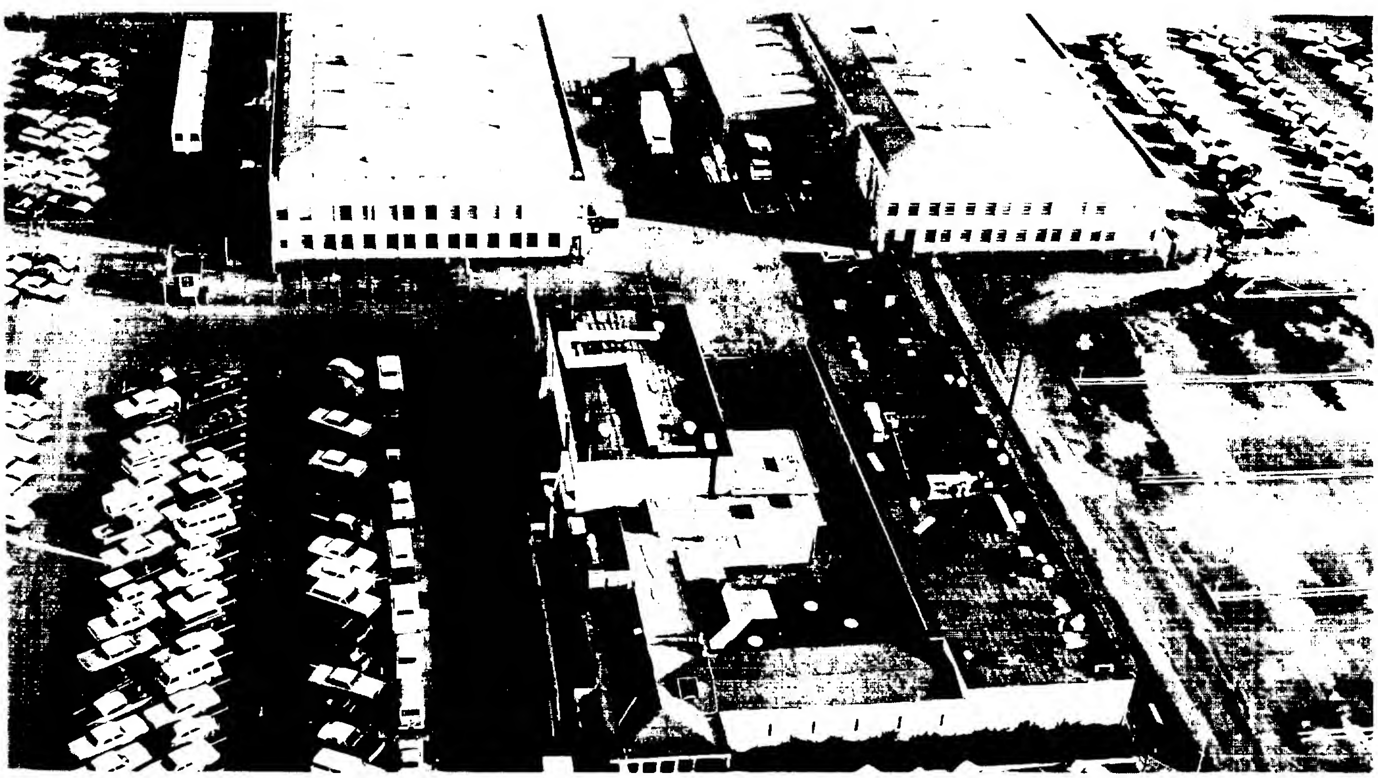


Figure 3-1

It was decided, therefore, to separate the WS-117L photo reconnaissance program into two distinct and ostensibly unrelated series: one identified as DISCOVERER (CORONA-THOR boost) and the other as SENTRY (later known as SAMOS-ATLAS boost). A press release announcing the initiation of the DISCOVERER series was issued in mid-January 1959 identifying the initial launchings as tests of the vehicle itself and later launchings as explorations of environmental conditions in space. Biomedical specimens, including live animals, were to be carried into space and their recovery from orbit attempted.

The new CORONA cover concept, from which the press release stemmed, called for a total of five biomedical vehicles; and three of the five were committed to the schedule under launchings three, four, and seven. The first two were to carry mice and the third a primate. The two uncommitted vehicles were to be held in reserve in event of failure of the heavier primate vehicle. In further support of the cover plan, ARPA was to develop two radiometric payload packages designed specifically to study navigation of space vehicles and to obtain data useful in the development of an early warning system (the planned MIDAS infrared series). It might be noted here that only one (DISCOVERER III) of the three planned animal carrying missions was actually attempted, and it was a failure. ARPA did develop the radiometric payload packages, and they were launched as DISCOVERERs XIX and XXI in late 1960 and early 1961.

The photo reconnaissance mission of CORONA necessitated a near polar orbit, either by launching to the north or to the south. There are few suitable areas in the continental United States where this can be done without danger of debris from an early in-flight failure falling into populated areas. Cooke Air Force Base near California's Point Arguello met the requirement for down-range safety because the trajectory of a southward launch would be over the Santa Barbara channel and the Pacific Ocean beyond. Cooke AFB was a natural choice because it was the site of the first Air Force operational missile training base and also housed the 672nd Strategic Missile Squadron (THOR). Two additional factors favored this as the launch area: (1) manufacturing facilities and skilled personnel required were in the near vicinity, and (2) a southward launch would permit recovery in the Hawaii area by initiating the ejection/recovery sequence as the satellite passed over the Alaskan tracking facility. The name of this base was changed from Cooke to Vandenberg AFB in October 1958. The CORONA launch sequence is shown in Figure 3-2.

Unlike the U-2 flights, launchings of satellites from US soil simply could not be concealed from the public. Even a booster as small as the THOR (small relative to present day space boosters) launches with a thunderous roar that can be heard for miles; the space vehicle transmits telemetry that can be intercepted; and the vehicle can be detected in orbit by radar skin-track. Although the fact of a launch having been made could not be concealed, maintenance of the cover story for the DISCOVERER series required that the launchings of the uniquely configured photographic payloads be closed to observation by uncleared personnel. Vandenberg

25X1

Illustrations
sent to
LMSC
3-4

was excellent as a launch site from many standpoints, but there was one feature of it that posed a severe handicap to screening the actual launches from unwanted observation. This handicap was that the heavily traveled Southern Pacific railroad passes through it. Operational parameters, including the requirement for daylight recovery and for seven denied area passes during daylight with acceptable sun angles, dictated a launch from Vandenberg in the early afternoon. Trains passing through the area broke up this afternoon launch window into a series of successive windows, some of which were of no more than a few minutes' duration. Even today, the space program at Vandenberg is plagued by having to time the launches to occur during one of the intervals between passing trains.

25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

SECTION IV

EARLY DEVELOPMENT PROBLEMS

Recovery presented problems in the early development period and throughout the early operational period. The planned recovery sequence involved a series of maneuvers, each of which had to be executed to near-perfection or recovery would fail. Immediately after injection into orbit, the AGENA vehicle was yawed 180° such that the recovery vehicle faced to the rear. This maneuver minimized the control gas which would be required for re-entry orientation at the end of the mission and protected the heat shield from what at that time was a deep concern for molecular heating. (Later in the J-3 design when these concerns had diminished, the vehicle was flown forward until re-entry.) When re-entry was to take place, the AGENA would then be pitched down through 60 degrees to position the satellite recovery vehicle (SRV) for retrofiring. Then the SRV would be separated from the AGENA and spin-stabilized by firing the spin rockets to maintain it in the attitude given it by the AGENA. Next, the retrorocket would be fired slowing down the SRV into a descent trajectory, and the spin of the SRV would be cancelled by firing the despin rockets. The retrorocket thrust cone was then separated, followed by the heat shield and the parachute cover. The drogue (or deceleration) chute would then deploy, and finally the main chute would open to lower the capsule gently into the recovery area. The primary recovery technique involved flying an airplane across the top of the descending parachute, catching the chute or its shrouds in a trapeze-like hook suspended beneath the airplane, and then winching the recovery vehicle aboard. Initially, C-119 Aircraft were used, but C-130 Aircraft replaced them later in the program. If the air catch failed, the recovery vehicle was designed to float long enough for a water recovery by a helicopter launched from a surface ship. Illustrations showing the recovery sequence and the aerial recovery of the capsule are provided as Figures 4-1 thru 4-3.

While the vehicle was still in the construction stage, tests were conducted of the aerial recovery technique by the 6593rd Test Squadron with poor results. Of 74 drops using personnel-type chutes, only 49 were recovered. Using one type of operational drop chute, only four were recovered out of 15 dropped, and an average of 1.5 aircraft passes were required for the hookup. Eleven drops of another type of operational chute resulted in five recoveries and an average of 2 aircraft passes for the snatch. Part of the difficulty lay in weak chutes and rigging and crew inexperience; however, the most serious problem was the fast drop rate of the chutes. Parachutes that were available to support the planned weight of the recovery vehicle had a sink rate of about 33 feet per second. What was required was a sink rate approaching 20 feet per second so that the aircraft would have time to make three or four passes, if necessary, for hookup. Fortunately, by the time space hardware was ready for launching, a parachute had been developed with a sink rate slow enough to offer a reasonable chance of air recovery.

25X1

The launch facilities at Vandenberg AFB were complete, and the remote tracking and control facilities which had been developed for WS-117L were ready for the first flight test of a THOR-AGENA combination in January 1959. The count-down was started for a launch on 21 January; however, the attempt aborted at launch minus 60 minutes. When power was applied to test the AGENA hydraulic system, certain events took place that were supposed to occur only in flight. The explosive bolts connecting the AGENA to the THOR detonated, and the ullage rockets fired. Ullage rockets are small solid propellent rockets attached to the AGENA. These rockets are fired just prior to ignition of the AGENA engine after its separation from the THOR to insure that the liquid AGENA propellants are pushed against the bottom of the tanks so that proper flow into the pumps will occur. The AGENA settled into the fairing attaching it to the THOR but did not fall to the ground, however appreciable damage was done. A program review conference was held in Palo Alto two days after the launch failure to examine the possible causes of these events and to assess its impact on the planned CORONA launch schedule. Fortunately, the problem was quickly identified as a timer malfunction. The design was corrected, and the system was ready for resumption of test launches at the rate of about one per month.

General Electric surfaced a new problem with the re-entry vehicle at the review conference having to do with the stability of the nose cone during re-entry. The cone was designed for a film load of 40 pounds, but the first missions would only be able to carry 20 pounds. GE reported that about three pounds of ballast would have to be carried in the forward end of the cone to restore stability. The program officers decided to add an instrument package as ballast for diagnostic purposes and for support of the biomedical cover story, thus converting what could have been dead weight into an extra advantage for this test series.

The test plan contemplated arriving at full operational capability at a relatively early date through sequential testing of the major components of the system; beginning with the THOR-AGENA combination alone; then adding the nose cone to test the ejection/re-entry/recovery sequence; and finally installing a camera for a full CORONA systems test. Whatever confidence the project planners had in the imminence of success at the start, however, soon must have begun to wane. Beginning in February 1959 and extending through June 1960, an even dozen launches were attempted with eight of these vehicles carrying cameras. All twelve were failures, and no film capsules were recovered from orbit. Of the eight camera-carrying vehicles, four failed to achieve orbit. Of the four vehicles that went into orbit, three experienced camera or film failures, and the fourth was not recovered because of a malfunction of the re-entry body spin rockets. Section V discusses problems and the solutions reached in the initial and successive launches of the CORONA system.

25X1

SECTION V

SUMMARIES OF EARLY OPERATIONS

DISCOVERER I

The on-pad failure of 21 January 1959 was not assigned a number in the DISCOVERER series, thus the second launch attempt was assigned number I. DISCOVERER I was launched on 28 February with a light engineering payload as a test of THOR-AGENA performance. No recovery was planned. For a time there was uncertainty as to what had happened to it because no radio signals were received. It was believed, on the basis of exit tracking, to have attained orbit, with speculation that the protective nose cone over the antennas was ejected just before the AGENA fired and that the AGENA then rammed into the nose cone damaging the antennas. This was before the term "super velocity" had been invented; today most people believe that DISCOVERER I landed somewhere near the South Pole.

DISCOVERER II

The second vehicle was launched on 13 April 1959. Orbit was officially announced about two hours later, along with a statement that the capsule carried a lightweight biomedical payload (as indeed it did). The Air Force reported on 15 April that plans to recover the capsule near Hawaii had been abandoned and that the capsule might descend somewhere in the Arctic. The announcement slightly understated the known facts. The capsule had ejected on the 17th orbit as planned, but a timing malfunction caused by a human programming error resulted in the ejection sequence being initiated too early. The capsule was down, probably somewhere in the near vicinity of the Spitsbergen Island north of Norway. In fact, there were later reports that the falling capsule had actually been seen by Spitsbergen residents. The Air Force announced on the 16th that the Norwegian government had authorized a search for the capsule, which would begin the following day. Planes scoured the area, and helicopters joined the search on the 20th. Nothing was found, however, and the search was abandoned on the 23rd. There was speculation at the time and some actual reconnaissance by the Norwegian Air Force which indicated that the capsule may have been recovered by a Soviet rather than an American recovery team.

The incident later became the subject of a book by Alistair MacLean, Ice Station Zebra, and of a 1968 movie of the same name. The fictionalized version departed rather substantially from the facts, and it is clear that no one who was involved in the CORONA Program acted as a technical consultant to the film producer.

25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

DISCOVERER III

Much publicity attended the launching of DISCOVERER III, some of it planned and some unplanned/unwanted. This was the first and only DISCOVERER flight to carry animals, four live black mice. Black mice were chosen in order to ascertain the possible hair-bleaching effects of cosmic rays. The mice were members of the C-57 strain, a particularly rugged breed. They had been "trained," along with 60 other mice, at the Air Force Aeromedical Field Laboratory at Holloman AFB. They were seven to ten weeks old and weighed slightly over one ounce each. A three day food supply was provided which consisted of a special formula containing peanuts, oatmeal, gelatin, orange juice, and water. Each mouse was placed in a small individual cage about twice its size, and each had a miniscule radio strapped to its back to monitor the effects of the space trip on heart action, respiration, and muscular activity.

The lift-off on 3 June 1959 was uneventful, but instead of injecting approximately horizontally, the AGENA apparently injected downward driving the vehicle into the Pacific Ocean.

The second try at launch several days later with a backup mouse "crew" was also a near abort when the capsule life cell humidity sensor suddenly indicated 100 percent relative humidity. The panic button was pushed and troubleshooters were sent up to check. They found that when the vehicle was in a vertical position, the humidity sensor was directly beneath the cages and it did not distinguish between plain water and urine. The cages were dried out and the vehicle launched; however, it again was unsuccessful falling into the Pacific Ocean.

Also, the timing of the launch was unfortunate. Two monkeys, Able and Baker, had survived a 300 mile flight in a JUPITER nose cone on 29 May in connection with another unrelated test program. However, Able died during minor surgery on 3 June to remove an electrode that had been implanted under his skin. The British Society Against Cruel Sports made a formal protest to the US Ambassador, and the press made an issue over the fatal mice flight, comparing it unfavorably with the Russians' successful launching of the dog, Laika, in SPUTNIK II back in November 1957 and demanding that orbit and recovery procedures be perfected before attempting future launches of mice or monkeys.

DISCOVERER IV

This flight, which was launched on 25 June 1959, was the first to carry a camera and was thus the first true CORONA mission attempt. The payload did not go into orbit because the AGENA failed to reach the required velocity. The original cover plan had called for launches three and four to carry mice, but because of the furor raised over the death of the mice on DISCOVERER III, no mice were included. Certain of the 25X1

official records refer to the mission as having carried mechanical mice (vibrators to simulate mouse activity), but this turns out to have been something that was talked about but never actually tried.

There was one amusing experiment on an early flight, and it may have been on DISCOVERER IV. A means was needed for concealing the payload doors from inquisitive eyes while the vehicle was on the launch pad. The scheme that was hurriedly devised was to cover the doors with fairings made of paper under which were strung two lengths of piano wire with ping pong balls attached to the forward ends of the wires. The thought was that as the vehicle accelerated during launch, the air flow along the vehicle skin would blow the ping pong balls to the rear, thus tearing off the paper and exposing the payload doors. The strip-away fairing was tested by attaching it to the side of a sports car and driving the car at high speed along the Bayshore Freeway (US Highway 101) late one evening. The test proved two things: (1) that the fairing would tear off as intended, and (2) that the Freeway patrolmen could easily overtake a vehicle traveling at 90 miles per hour. Since the test indicated a "go" situation, at 2 a.m. on a foggy, chilly morning under a blaze of floodlights, a few cents worth of paper, piano wire, and ping pong balls were affixed to a multimillion dollar space vehicle.
In parallel with the paper/ping pong ball fix, a security and environmental shroud was being designed. These shrouds proved extremely valuable to the program in protecting the sensitive thermal surface from salt water spray.

DISCOVERER V

DISCOVERER V was launched on 13 August 1959 and attained orbit with a camera payload. The temperature within the spacecraft was lower than planned, and the camera failed on the first orbit. The recovery capsule was ejected at the proper time but for reasons then unknown did not show up in the recovery zone. Early in 1960 an unidentified object was discovered in space in a near polar orbit. It was finally determined to be the recovery capsule of DISCOVERER V. Instead of deboosting it into a descent trajectory, failure of the spin rockets had caused the retrorockets to accelerate it into a higher orbit with an apogee of 1,058 miles.

DISCOVERER VI

The sixth launch was on 19 August 1959. The vehicle achieved orbit, but the camera failed on the second revolution, and the retrorocket malfunctioned on the recovery attempt.

DISCOVERER VII

The next launch was on 7 November 1959. The AGENA failed to go into orbit.

25X1

DISCOVERER VIII

The vehicle was successfully launched on 20 November 1959, but the AGENA inserted into an eccentric orbit with an apogee of 913 miles. The camera also failed again. The satellite recovery vehicle was ejected successfully, but the parachute failed to open.

It had become plain by the end of November 1959 that many things had to be done to correct the multiple failures that were plaguing the CORONA system. Eight THOR-AGENA combinations and five cameras had been expended with nothing to show for the effort except accumulated knowledge of the system's weaknesses. The project technicians knew what was going wrong but not always why. Through DISCOVERER VIII, the system had experienced the following major failures:

A. One misfired on the launch pad.

B. Three failed to achieve orbit.

C. Two went into highly eccentric orbits.

D. One capsule ejected prematurely.

E. Two cameras operated briefly and then failed.

F. One camera failed entirely.

G. One experienced a retrorocket malfunction.

H. One had very low spacecraft temperature.

A panel of consultants reviewed the various failures and their probable causes and concluded that what was needed most was "qualification, requalification, and multiple testing of component parts" before assembling them and sending them aloft. This called for more money. Accordingly, Bissell submitted a project amendment to the DDCI on 22 January 1960 asking approval of an additional [redacted] to cover the costs of the testing program. He apologized to General Cabell for submitting a request for funds to pay for work that was already under way, "Although such a sequence is regrettable, there has been considerable confusion in this program as to what the amount of the overruns would be and this had made it difficult to obtain approvals in an orderly fashion in advance."

25X1 NRO

As of the fall of 1959, major problems remained to be solved in achieving an acceptable orbit, in camera functioning, and in recovering the film capsule. The more serious of the specific failures were:

A. The AGENA vehicle was designed for use with both the THOR and the ATLAS boosters. The ascent technique used by the AGENA vehicle was essentially the same in both combinations, but there were significant differences in the method of employing the booster. In the CORONA Program, in order to conserve weight, the THOR booster followed a programmed trajectory using only its autopilot. Also, the THOR thrust

25X1

[redacted]

was not cut off by command at a predetermined velocity (as in the ATLAS); instead its fuel burned to near exhaustion. This relatively inaccurate boosting profile, coupled with the low altitude of CORONA orbits, imposed severe orbital injection constraints. At a typical injection altitude of 120 miles, an angular error of plus or minus 1.1 degrees or a velocity deficit of as little as 100 feet per second would result in failure to complete the first orbit. This had happened repeatedly. Lasting relief from this problem lay some distance in the future; a more powerful AGENA was being developed, and the weight of instrumentation for measuring in-flight performance on the early flights would be reduced on later operational missions. The short term remedy lay in a drastic weight reduction program. This was carried out in part (literally, it is said) by attacking surplus metal with tin snips and files.

B. To conserve weight the system was designed to operate without pressurization, as a result the acetate base film was tearing or breaking in the high vacuum existing in space and causing the camera to jam. A solution for this problem was found in substituting polyester for acetate base film. The importance to the reconnaissance program of this change in film bases cannot be overemphasized. It ranks on a level with the development of the film recovery capsule itself.

C. The equipment was built to work best at an even and predetermined temperature. To save weight, only passive thermal control was provided. The spacecraft's internal temperature had varied on previous flights, and it was much lower than desired on one flight. An interim solution for this problem was found in varying the thermal painting of the vehicle skin. Figure 5-1 shows an example of the thermal painting on a later CORONA system.

D. The spin/despin rockets used to stabilize the recovery vehicle during re-entry had a tendency to explode rather than merely to fire. Several had blown up in ground tests. A solution was found in substituting cold gas spin and despin rockets.

E. One of the most intractable problems, which was to persist for many months, was that of placing the Satellite Recovery Vehicle (SRV) into a descent trajectory that would terminate in the recovery zone. This required ejecting the SRV from the AGENA at precisely the right time and decelerating it by retrorocket firing to the correct velocity and at a suitable angle. There was very little margin for error in this phase; one second of error in ejection timing represented five miles displacement at the recovery point. A retrovelocity vector error of more than 10 degrees would cause the capsule to miss the recovery zone completely.

<u>DISCOVERER IX</u>

A standdown was in effect from 20 November 1959 until 4 February 1960 to allow time for intensive R&D efforts to identify and eliminate the causes of failure. During this period of problem solving, one amusing

25X1

CORONA J-3 SYSTEM THERMAL PAINTING

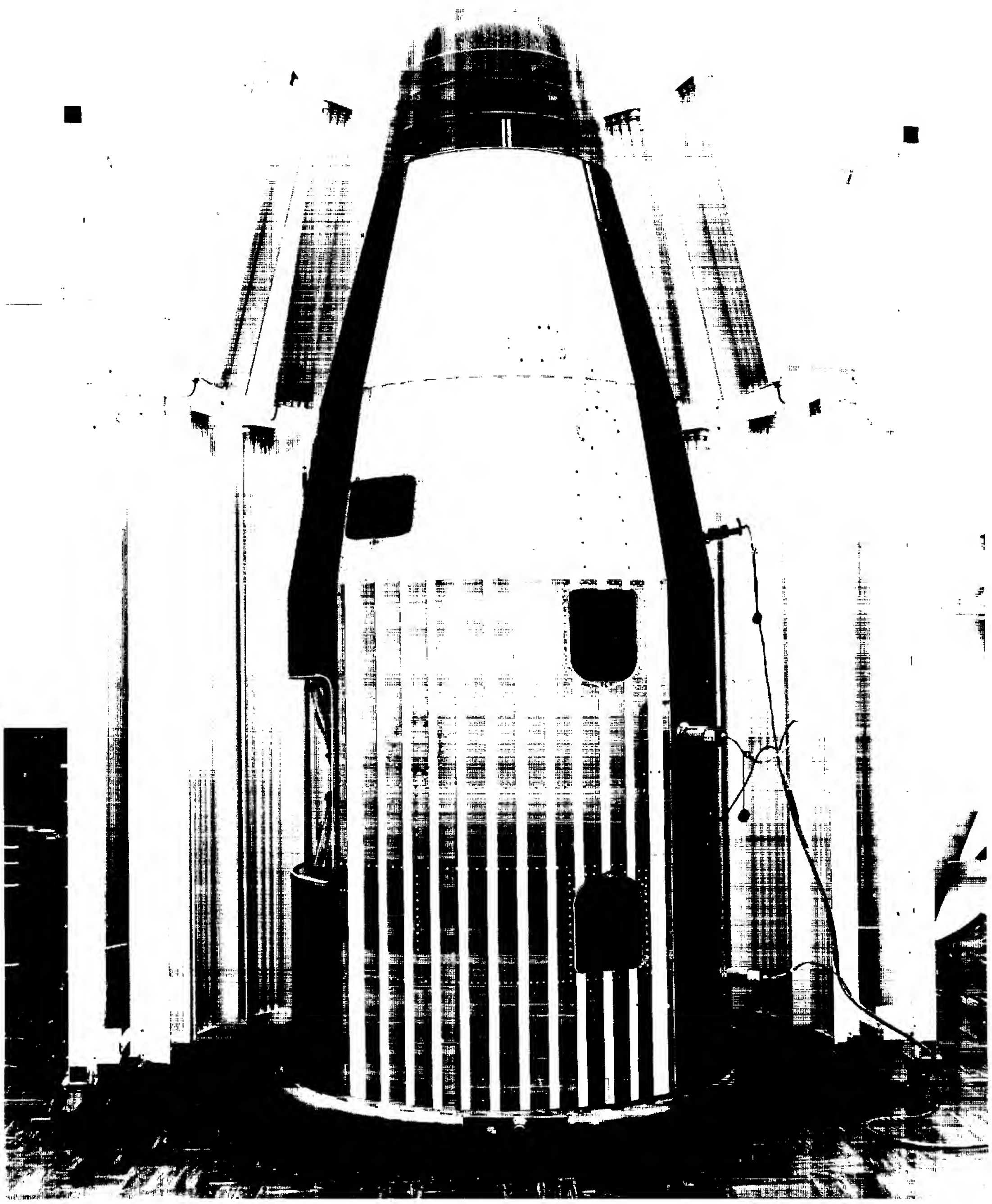


Figure 5-1

25X1

and innovative design bears mention. A cooler was needed for the fairing interface which was heating up during ascent. A water receptacle was installed around the leading edge of the fairing, the idea being that the water would boil during ascent and the steam would carry away the heat. In order to contain the water and prevent sloshing, something absorbent, soft, and easy to work with was required. After conducting a test program on various materials, the design engineer chose "Modess because...." The reservoir was filled using a large hypodermic needle poked through the small holes in the water receptacle. Each hole was then sealed with wax. DISCOVERER IX was launched on 4 February but failed to achieve orbit.

DISCOVERER X

The first recovery of film from a CORONA vehicle occurred from DISCOVERER X which was launched on 19 February 1960, but in a manner such that no one boasted of it as being a "first." The THOR booster rocket began to fishtail not long after it left the launch pad and was destroyed by the range safety officer at 52 seconds after lift-off. The payload came down about a mile from Pad 5 and was located by helicopter, which put down a team to disarm the pyrotechnics and guard the payload until it could be picked up. The recovery was made by a crew that rode to the scene by Jeep. This was one of the few failures for the remarkable Douglas launch team which prepared the THOR boosters at Vandenberg AFB, although they did have many exciting moments with the early launches. Several of the crew were holdovers from the German rocket "broomlighters" who during some of the early German launches would ignite reluctant rocket engines with kerosene soaked brooms. At Vandenberg AFB they did not have to resort to this tactic, but the "Douglas Daredevils" were required on numerous occasions to return to the launch pad as late as T-15 seconds to unfreeze valves.

DISCOVERER XI

DISCOVERERS VII through X carried only a quarter of a load of film (10 pounds) to permit the carrying of additional instrumentation for testing vehicle performance. DISCOVERER XI was launched on 15 April 1960 carrying a camera and 16 pounds of film. A reasonably good orbit was achieved (380 miles at apogee and 109.5 miles at perigee), and the camera operated satisfactorily. All of the film was exposed and transferred into the recovery capsule. Unfortunately, the problem of the exploding spin rockets, which had been observed in ground tests, occurred during the recovery sequence and the payload was lost. It might be noted that this was the first mission on which the camera operated successfully throughout the mission, primarily because of the change from acetate base to polyester base film.

25X1

DISCOVERER XII

Another standdown, this one a major one, was imposed following the failure of DISCOVERER XI. As of mid-April 1960, there had been 11 launches and two aborts on the pad. Seven of the launches achieved orbit, but no capsules had been recovered. DISCOVERER XII was planned as a diagnostic flight, without camera payload, heavily instrumented to determine precisely why recovery of capsules had failed previously. The vehicle was launched on 29 June 1960, but the AGENA failed to go into orbit.

DISCOVERER XIII

The next flight, on 10 August 1960, was launched as a repeat of the DISCOVERER XII diagnostic flight, without camera and film. The vehicle was launched and successfully inserted into orbit. The recovery package was ejected on the 17th orbit, and retrofiring and descent were normal, except that the capsule came down well away from the planned impact point. The nominal impact area was approximately 250 miles south of Honolulu where C-119 and C-130 aircraft circled awaiting the capsule's descent. The splash-down occurred about 330 miles northwest of Hawaii. The airplanes were backed up by surface ships deployed in a recovery zone with a north-south axis of some 250 miles and an east-west axis extending about 550 miles to either side of the predicted impact point. Although beyond the range of the airborne recovery aircraft, the DISCOVERER XIII capsule descended near enough to the staked out zone to permit an attempt at water recovery. A ship reached the scene before the capsule sank and fished it out of the ocean. Much of the credit for this achievement was attributed to the successful use of the cold gas spin and despin system. This type system was initially flown on DISCOVERER XII.

For the first time ever, man had orbited an object in space and recovered it according to plan. This American space "first" beat the Russians by just nine days. The Soviets had tried to recover SPUTNIK IV the previous May, but failed when the recovery capsule ejected into a higher orbit. They did succeed in deorbiting and recovering SPUTNIK V carrying the dogs, Belka and Strelka, on 20 August 1960.

We have all watched television coverage of the US manned spaceflight programs with the recovery of astronauts and capsules after splash-down in the ocean. A helicopter flies from the recovery ship to the floating capsule and drops swimmers to attach a line to the capsule. After the astronauts are removed, the helicopter hoists the capsule from the water and carries it to the recovery ship. What few know is this recovery technique was developed for and perfected by the CORONA Program as a backup in event of failure of the air catch.

Arrangements were made for extensive publicity concerning this success in recovering an object from orbit, in large measure to support the cover story of DISCOVERER as an experimental space series. News 25X1

photos were released of the lift-off from Vandenberg, of the capsule floating in the ocean, and of the recovery ship, Haiti Victory. President Eisenhower displayed the capsule to the press, and it was later placed on exhibit in the Smithsonian Institution for public viewing. The Illustrated London News covered the story as shown in Figure 5-2.

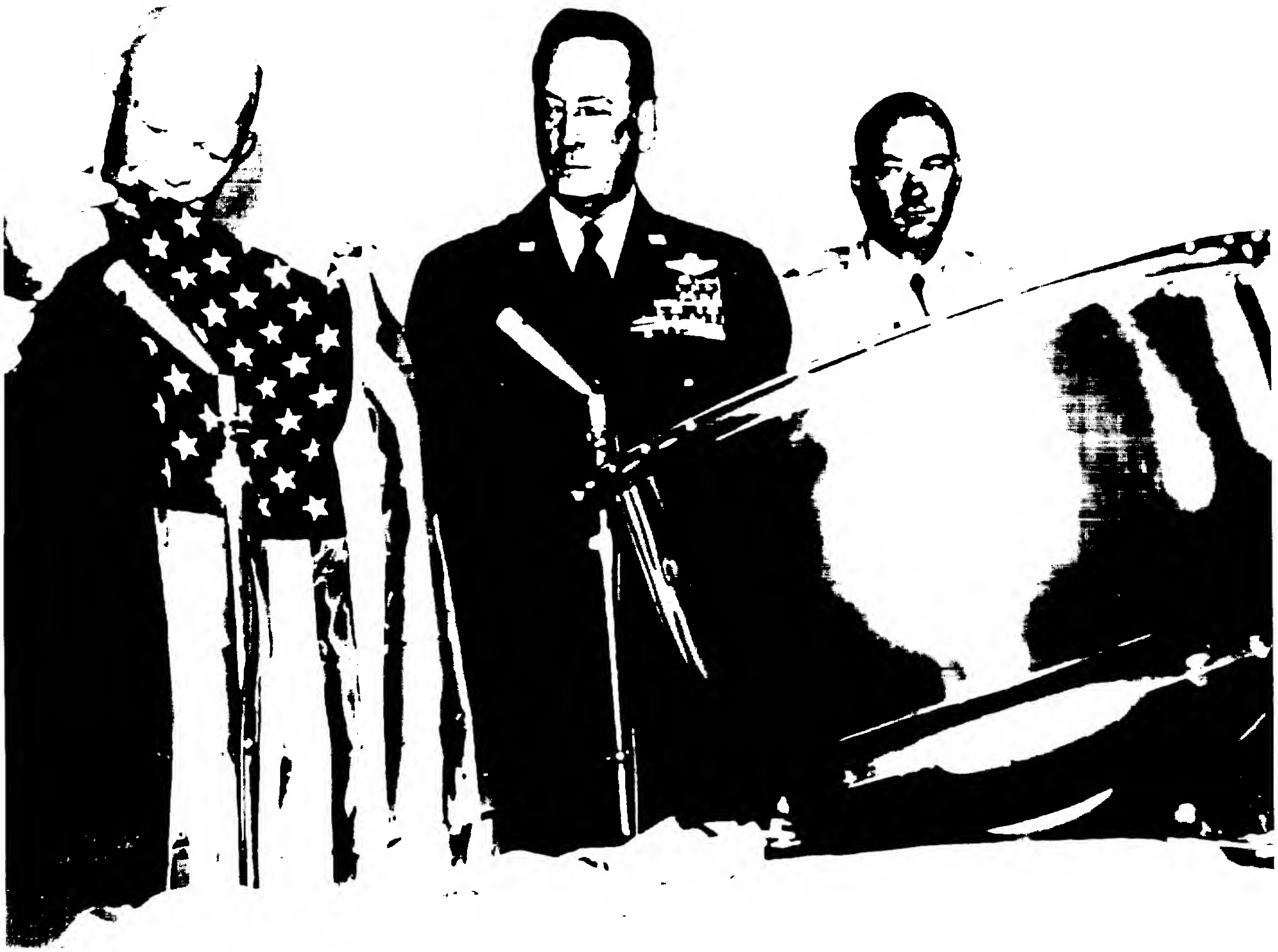
In ancitipation of the first recovery being a reconnaissance mission, a cover plan had been developed under which the actual capsule would be switched in transit through Sunnyvale. Since DISCOVERER XIII was a diagnostic flight, the project office was spared the necessity of executing a clandestine switch of capsules prior to shipment to Washington; and the President and Smithsonian received the actual hardware from the first recovery including a flag which President Eisenhower displays in Figure 5-3.

CORONA development had been persistently and energetically pursued in the face of adversity because of the overwhelming intelligence needs of the period. The initial planning of CORONA began at a time when we did not know how many BEAR and BISON aircraft the Soviets had, whether they were introducing a new and far more advanced long-range bomber than the BISON, or whether they had largely skipped the buildup of a manned bomber force in favor of missiles. There had been major changes in intelligence estimates of Soviet nuclear capabilities and of the scope of the Soviet missile program on the basis of the results of the relatively small number of U-2 missions approved for the summer of 1957. However, by 1959, the great "missile gap" controversy was very much in the forefront. The Soviets had tested ICBMs at ranges of 5,000 miles proving they had the capability of building and operating them. What was not known was where they were deploying them operationally and in what numbers. In the preparation of the National Intelligence Estimate for Guided Missiles in the fall of 1959, the various intelligence agencies held widely diverse views on Soviet missile strength. Nineteen Sixty ushered in an election year in which the missile gap had become a grave political issue, and the President was scheduled to meet with Soviet leaders that spring without the benefit of hard intelligence data. The U-2 had improved our knowledge of the Soviet Union, but it could not provide area coverage and the answers to the critical questions; and it was increasingly becoming more of a political liability than an intelligence asset. Most experts felt that it was only a matter of time until one was shot down as occurred in May 1960. This incident resulted in ending the U-2 reconnaissance of USSR.

The successful recovery of a CORONA SRV, even though it contained no film, was the first assurance of imminent success for a photographic reconnaissance satellite capability.

25X1

A FIRST FOR CORONA



First Recovery from Space

Figure 5-3

25X1

SECTION VI

SUCCESS!, AN ERA BEGINS

Success! DISCOVERER XIV was launched on 18 August 1960, one week after the successful water recovery of the DISCOVERER XIII capsule. The vehicle carried a camera and a 20 pound load of film. The camera operated satisfactorily, and the full load of film was exposed and transferred to the recovery capsule. The AGENA did not initially position itself in orbit so as to permit the recovery sequence to occur. It was on the verge of tumbling during the first few orbits, and an excessive quantity of gas had to be used in correcting this condition. Fortunately, vehicle attitude became stabilized about midway through the scheduled flight period, thus relieving the earlier fear that recovery would be impossible. The satellite recovery vehicle was ejected on the 17th pass, and the film capsule was recovered by air snatch.

Captain Harold E. Mitchell of the 6593rd Test Squadron piloting a C-119 (flying boxcar) called Pelican 9 and crew successfully hooked the descending capsule on his third pass. Upon arrival at Hickam Air Force Base, Hawaii, Captain Mitchell was decorated with the Distinguished Flying Cross and members of his crew were awarded the Air Medal for their accomplishments. Ironically, Captain Mitchell and the Pelican 9 had been one of the primary recovery aircraft for DISCOVERER XIII; however, failure to make an aerial recovery on this mission relegated them to a backup position for DISCOVERER XIV. Figure 6-1 is a photograph of Captain Mitchell, another crew member, and the Pelican 9. A photograph of then Senator Kennedy viewing the DISCOVERER XIV capsule on display at Vandenberg AFB is presented as Figure 6-2.

The film was flown to the Eastman Kodak Processing Facility in Rochester, New York, for processing and duplication. The EK Facility accomplished all processing and duplication of CORONA missions until 1962, after which the task was shared between EK and the Air Force Special Projects Production Facility (AFSPPF) at Westover Air Force Base, Massachusetts. The photography was delivered to the Photographic Intelligence Center, now known as the National Photographic Intelligence Center (NPIC), and other intelligence centers.

This one CORONA mission yielded more photographic area coverage than the total of all U-2 missions that had been flown over the Soviet Union. Aside from the expected lower resolution, the only major deficiencies in the photography were plus and minus-density bars running diagonally across the format. Some were due to minor light leaks, and some were the result of electrostatic discharge known as corona. There are two types of corona markings: (1) a glow which caused the most difficulty, and (2) a dendritic discharge which is more spectacular in appearance. Figure 6-3 shows examples of corona discharge marks made by the CORONA cameras.

25X1

ANOTHER FIRST - FILM RECOVERED

Figure 6-2

25X1

A press release announced the success of the mission but naturally made no mention of the real success; the delivery of photographic intelligence. The announcement noted that the satellite had been placed into an orbit with a 77.6 degree inclination, an apogee of 502 miles, a perigee of 116 miles, and an orbital period of 94.5 minutes. A retrorocket had slowed the capsule to re-entry velocity, and a parachute had been released at 60,000 feet. The capsule, which weighed 84 pounds at recovery, was caught at 8,500 feet by a C-119 Aircraft on its third pass.

The program officers did not take the success of DISCOVERER XIV to mean that their problems with the system were at an end, even though many of the earlier difficulties had been surmounted. The orbital injection technique had improved to a point where vehicles were repeatedly put into orbit with injection angle errors of less than four-tenths of a degree. The timing of the initiation of the recovery sequence had been so refined that ejection of the DISCOVERER XI SRV occurred within five seconds of the planned time. Parachute deceleration and air catch of the capsule had been accomplished repeatedly with capsules dropped from high altitude balloons. The last two cameras placed in orbit had operated well. However, there were other critical problems that remained to be solved. Foremost among them was that of consistently achieving the correct retrovelocity and angle of re-entry of the recovery vehicle. Even though the DISCOVERER XIV capsule was successfully recovered aerially, the overall subject of recovery received major attention during the next few months.

Four more cameras were launched within the next four months with one success and three failures. DISCOVERER XV was sent aloft on 13 September. The vehicle was successfully inserted into orbit, and the camera functioned properly. However, the recovery vehicle re-entered at the wrong pitch attitude causing the capsule to come down outside the recovery zone, again demonstrating that the concern over the retrofiring sequence was well founded. The capsule was located, but it sank before a recovery ship could reach it. DISCOVERER XVI was launched on 26 October, but the AGENA failed to go into orbit because of a malfunction of a timing device.

The first ten camera-equipped vehicles carried what was known as the C camera, which was a single, vertical-looking, reciprocating, panoramic camera that exposed the film by scanning at a right angle to the line-of-flight. DISCOVERER XVI carried the first of a new series of cameras known as the C Prime (C'). The C' differed only slightly from the original configuration and was essentially little more than a follow-on procurement of the C camera.

The DISCOVERER XVII mission was launched on 12 November and travelled the entire cycle including a successful air catch, except for one mishap. The film broke after 1.7 feet of the acetate base leader had fed through the camera. It was the first of the two day missions and the capsule was recovered on the 31st orbit. 25X1

Success again! DISCOVERER XVIII was launched on 10 December 1960 carrying 39 pounds of film. Orbit was achieved, and the camera worked well exposing the entire film load. The recovery vehicle was ejected on revolution 48 after three days in orbit, and the capsule was retrieved by air snatch. This was the first successful mission employing the C' camera and the AGENA B second stage. There was fogging on the first, second, and last frame of each photo pass due to minor light leaks, but image quality was otherwise as good as the best from DISCOVERER XIV.

On the next ten launches, extending from December 1960 thru 3 August 1961, only four were CORONA missions. DISCOVERERS XIX and XXI carried radiometric payloads in support of the CORONA cover story, and were not intended to be recovered. DISCOVERER XXI included an experiment that was to be of major significance in the later development of CORONA and other space programs. The result of this experiment was the successful restart of the AGENA engine in space.

DISCOVERER XX was the first of a dozen launches extending over a period of three years carrying mapping cameras, a program sponsored by the US Army which the President had approved for inclusion within the CORONA project. The purpose of the mapping program, which was known as ARGON, was to obtain precise geodetic fixes and an extension of existing datum planes within the Soviet Union. ARGON accomplished its intended goal and was considered a successful program in spite of resolution and focal length limitations of the mapping camera and the many flight difficulties which were encountered.

DISCOVERER XX was in itself a failure because: (1) the camera failed, (2) there were no shutter firings, and (3) the orbital programmer malfunctioned. This latter failure led to an important change in control procedures for CORONA. On this and all prior flights the recovery sequence was initiated automatically by an ejection command cut into the program tape. The program timer failed temporarily on orbit 31 of this mission causing the entire sequence to be about one-half cycle out-of-phase. The automatic initiation of the recovery sequence was eliminated from the program tape on subsequent missions. Thereafter, the positive issuance of an ejection command was required.

Of the four CORONA missions attempted between December 1960 and August 1961, two did not go into orbit as a consequence of AGENA failures, and two were qualified successes. DISCOVERER XXV was launched on 16 June and exposed its full load of film. The air catch failed, but the back-up water recovery was successful. The camera failed on revolution 22 of DISCOVERER XXVI, which was launched on 7 July, but three-quarters of the film was exposed and recovered by air catch.

As of August 1961, a total of 17 camera-carrying CORONA missions had been attempted, with usable photography being recovered from just four of them. An appreciation of the capacity of the CORONA camera

25X1

to photograph large areas of the earth's surface can be obtained from the fact that these four successful missions had yielded plottable coverage of some 13 million square miles which represented nearly one-half of the total area of interest. Part of this coverage was redundant as a consequence of multiple photographic passes over the same target areas. This situation continued as long as the mission life remained at two days.

The first substantial upgrading of the CORONA camera system came with the introduction in August 1961 of the C Triple Prime (C''') camera. The original C camera was a scanning panoramic camera in which the cycling rate and the velocity-over-height (V/h) ratio were constant and selected before launching. Image motion compensation (IMC) was fixed mechanically to the V/h ratio. A brief explanation of these terms follows:

A. A means must be provided for matching the number of film exposures in a given period of time (camera cycling rate) with the varying ratio between vehicle altitude and velocity on-orbit (velocity-over-height) so that the ground area is photographed in a series of swaths with neither gaps nor excessive overlapping in the coverage.

B. If the subject moves just as a snapshot is taken with a hand held camera, and if the camera shutter speed is not fast enough to "stop" the motion, the photographic image will be smeared. To a camera peering down from an orbiting CORONA space vehicle, the earth's surface appears to be passing beneath the camera at a speed of roughly five miles per second. A camera photographing the earth's surface from a satellite moving at that speed would yield smeared photography if some means were not provided for stopping the relative motion. The technique used in accomplishing this is known as image motion compensation.

The C''' was the first camera built totally by Itek Corp. The C''' was also a reciprocating camera with a rotating lens cell which exposed the film during a segment of its rotation. The new camera had a larger aperture lens, an improved film transport mechanism, and a greater flexibility in command of camera and vehicle operations, especially with regard to control of the V/h factor. The larger aperture lens permitted use of slower film emulsions which, combined with the improved resolving power of the lens itself, offered the prospect of yielding photography with a ground resolution approximately twice as good as with the C and C' cameras.

The first C''' camera system with a 39 pound film load was launched on 30 August 1961. The mission was a success, with the full film load being transferred and with ejection and recovery occurring on the 32nd revolution. However, all frames of the photography were out-of-focus. The cause was identified and corrected by redesigning the scan head. Seven more missions were launched during the last four months of

25X1

1961, three with the C' camera and four with the C'''. Six of them attained orbit and the cameras operated satisfactorily on all six. Film was recovered from four of the missions. The last of the four, DISCOVERER XXXVI which carried a C''' camera system, was rated the best mission to date. It also had a cover assignment which was the injection of a secondary satellite, dubbed OSCAR (Orbital Satellite Carrying Amateur Radio), into a separate orbit. OSCAR was a small radio satellite broadcasting a signal on 145 megacycles for pickup by amateurs as an aid in the study of radio propagation phenomena. Figure 6-4 provides a photograph of DISCOVERER XXXVI on the launch pad.

Slowly but surely the bugs were being worked out, but it always seemed that just as one was laid to rest another arose to take its place. Perhaps what was actually happening was that various sets of problems existed simultaneously, but some of them were masked by others. The elimination of a particular problem made it possible to recognize the significance of another. The recent success had resulted largely from correcting weaknesses in the payload portion of the system. At the same time, difficulties in the AGENA vehicle began to surface. Of the last seven missions in 1961, four experienced on-orbit difficulties with the AGENA power supply or control gas system.

Power system components for general use in satellite systems were designed, developed, and tested in the CORONA Program. Foremost among those components were the static electronic inverters used to convert direct current battery energy into the various alternating current voltages required by the other subsystems. Static inverters, which were first flown aboard CORONA vehicles, were considered essential because they had half the weight and double the efficiency of their rotary counterparts. Unfortunately, they are rather temperamental instruments. The history of inverter development had been marked by high failure rates in system checkouts on the ground. Despite the lessons that had been learned and the improvements in circuit design that resulted from them, the recent on-orbit power failures demonstrated a need for further research and development.

The AGENA failed on DISCOVERER XXXVII, launched on 13 January 1962, and the payload did not go into orbit. It was the last mission to carry the C''' camera system, and with it the DISCOVERER series came to an end. After 37 launches or launch attempts, the cover story for DISCOVERER had simply worn out. With the improved record of success and the near certainty of an even better record in the future, it seemed likely that there would be as many as a dozen and a half to two dozen launches per year for perhaps years to come. The cover story that DISCOVERER was an experimental series had ceased to be tenable, and no other cover story was available to account for the number of launches and their unique mission profiles. So, beginning with the 38th launch, CORONA missions were announced merely as being Air Force satellite launches.

25X1

On 18 April 1962, the Air Force announced the issuance of a new directive classifying all information pertaining to military satellites and eliminating the DISCOVERER, SAMOS, and MIDAS series designations.

25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

SECTION VII

THE DUAL CAMERA SYSTEM, MURAL

The 1961 development effort was not confined to improving the performance of the existing system. A major development program was concurrently underway on an improved camera subsystem. A contract was awarded on 19 August 1961, retroactively effective to 20 March, for a new camera configuration to be known as MURAL. The MURAL camera system (M) consisted essentially of two C''' cameras mounted with one pointing slightly forward and the other slightly aft. Two 40 pound rolls of film were carried in a double spool film supply cassette. The two film webs were fed separately to the two cameras where they were panoramically exposed during segments of the lens cells' rotations and then were fed to a double spool takeup cassette in the satellite recovery vehicle. The system was designed for a mission duration of up to four days.

The vertical-looking C, C', and C''' cameras had photographed the target area by sweeping across it in successive overlapping swaths. The MURAL concept involved photographing each swath area twice. The Forward-looking camera first photographed the swath at an angle 15 degrees from the vertical; approximately six frames later, the Aft-looking camera photographed the same swath at an angle also 15 degrees from the vertical. When the two resulting photographs of the same area or object were properly aligned in a stereo-microscope, the photography would appear to be three-dimensional. Simultaneous operation of both instruments was required for stereo photography. If either camera failed, photography of that area could still be obtained with the exception that it could be viewed in only two dimensions.

The first MURAL camera system was launched as program flight number 38 on 27 February 1962. An anomaly occurred during re-entry of this mission. The Re-entry Vehicle (RV) heat shield failed to separate and was recovered by the aircraft along with the capsule. This anomaly provided valuable diagnostic data on the re-entry effects. This turned out out to be especially significant when program extensions caused the shelf life of the heat shields to be a major concern. The 26th, and last in the series, was launched on 21 December 1963. Twenty of the SRVs were recovered, 19 of them by air snatch. The one water recovery was of a capsule that splashed down a thousand miles from the nominal impact point. An interesting aspect of this recovery was that the capsule turned upside down in the water causing loss of the beacon signals. It was located during the search by an alert observer who spotted the sun reflecting off the gold capsule. Of the six vehicles that failed, two malfunctioned in the launch sequence, one SRV failed to eject properly, and three capsules came down in the ocean and sank before they could be recovered. Twenty successes out of 26 tries were a remarkable record when viewed against the difficulties experienced only two years earlier.

25X1

The three capsules that sank came down in or near the recovery zone indicating that the problems previously encountered in the re-entry sequence had been solved. However, they were not supposed to sink so quickly; one of them floated for less than three minutes. To minimize the chance of a capsule being retrieved by persons other than the American recovery crew, the capsules were designed to float for a period ranging originally from one to three days and then to sink. The duration of the floatation period was controlled by a capsule sink valve containing compressed salt which would dissolve in sea water at a rate that could be predicted within rather broad limits. When the salt plug had dissolved, water entered the capsule and it sank, simple but ingenious.

Other significant improvements in the CORONA Program were inaugurated during the lifetime of the MURAL system. One of them was an aid to photointerpretation. In order to read out the photography, there are certain collateral facts that the photointerpreter must be told or be able to determine about each frame of the photography. He must be able to ascertain the portion of the earth's surface that is imaged, the scale of the photography, and its geometry. In simplest terms, he must know where the vehicle was and how it was oriented in space at the precise time the picture was taken. Until 1962, the ground area covered by a particular frame of photography was identified by combining data provided on the orbital path of the vehicle with the time of camera firing. The orientation or attitude of the vehicle on-orbit was determined from horizon photographs recorded at each end of every other frame from a pair of Horizon cameras that were included in the CORONA camera system.

Beginning with the first of the MURAL flights, an Index camera was incorporated into the photographic system, and a Stellar camera was added a few missions later. The short focal length Index camera took a small scale photograph of the area being covered on a much larger scale by successive sweeps of the pan cameras. The small scale photograph, used in conjunction with orbital data, simplified the problem of matching the pan photographs with the terrain. Photographs taken of stars by the Stellar camera, in combination with those taken of the horizons by the Horizon cameras, provided a more precise means of determining vehicle attitude on-orbit.

The photography from program flight number 47, a MURAL mission launched on 27 July 1962, was marred by heavy corona [redacted] The corona problem was a persistent one, disappearing for a time only to reappear later, and had become even more severe with the advent of the complicated film transport mechanisms of the MURAL camera. Corona marking was caused by discharge of static electricity generated by friction between moving parts of the system, especially between the film and the film rollers. The problem was eventually solved by modifications of the parts themselves and by rigid qualification testing of them. [redacted]

25X1
NRO
25X1
25X1
NRO

[redacted]

25X1
NRO

25X1

[redacted]

SECTION VIII

THE TWO BUCKET JANUS CAMERA SYSTEM

The boosting capacity of the first-stage THOR was substantially increased in early 1963 by strapping to the THOR a cluster of small solid propellant rockets which were jettisoned after firing. This thrust augmented THOR (TAT), was first used for the launching of the heavier LANYARD camera system. LANYARD was developed within the CORONA Program as a film recovery modification of one of the cameras designed for the SAMOS system and, with its longer focal length, was expected to yield better resolution than the CORONA cameras. It had a single lens cell capable of stereoscopic coverage by swinging a mirror through a 30 degree angle. Three flights were attempted, only one of which was partially successful. The camera had a serious lens focus problem which was later identified as being caused by thermal effects. The problem was then corrected. The LANYARD Program was initiated as an interim system pending the completion of a high resolution spotting system then under development by the Air Force. It was cancelled shortly thereafter because of the success of the spotting system. The TAT booster itself was a significant success permitting the launch of heavier, more versatile CORONA systems.

Program flight number 69, launched on 24 August 1963, introduced the next major upgrading of the CORONA system, the first two bucket configuration. The film recovery capsule is commonly referred to as a bucket. The new modification, which was known as the JANUS system, or CORONA-J, retained the MURAL stereoscopic camera concept but added a second film capsule and recovery vehicle. With two satellite recovery vehicles in the system, film capacity was increased to 160 pounds. The two bucket system was designed to be deactivated or stored on-orbit in a passive (Zombie) mode for up to 21 days. This permitted the recovery of the first bucket after half of the film supply was exposed. The second bucket could begin filling immediately thereafter, or its start could be delayed for a few days. A major redesign of the command and control mechanisms was required to accommodate the more complicated mission profile of the two bucket system.

As with each of the early modifications of CORONA, the CORONA-J system had a few bugs. On the first mission, the shutter on the Master Horizon camera remained open approximately 1,000 times seriously fogging the adjacent panoramic photography, and the AGENA current inverter failed in mid-flight making it impossible to recover the second bucket. Also, this system initially experienced a rather severe heat problem, which was solved by reducing the thermal sensitivity of the camera and by better control of vehicle skin temperature through shielding and varying the paint pattern.

25X1

Back in 1960 and 1961, the successful recovery of a CORONA film bucket was an "event." Two years later when the system was referred to as J-1, success had become routine, and a failure was an "event." By the end of 1966, 37 J-1 systems had been launched, 35 of them put into orbit, and 64 buckets of film recovered. There were no failures at recovery in the three years following 1966, when 28 buckets were launched and 28 buckets recovered. Also, mission duration was greatly expanded during the lifetime of the J-1 system. A mission in June 1964 yielded four full days over target on each of the two buckets. Five full days of operation on each bucket was attained in January 1965. In April 1966, the first bucket was recovered after seven days in orbit. A 13 day mission life was achieved in August 1966, and this was increased to 15 days in June 1967.

The increased mission life and excellent recovery record resulted from a number of successive improvements that were incorporated into the J-1 time period. Among them was a subsystem known as LIFEBOAT, a completely redundant and self-contained apparatus built into the AGENA that could be activated for recovering the SRV in event of an AGENA power failure. Another improvement was the introduction of the new and more powerful THORAD booster. A third was the addition of a rocket orbit adjust system. At times, the CORONA vehicles were flown into quite a low perigee over the target areas in order to increase the scale of the photography; however, the low perigee resulted in a relatively rapid decay of the orbit. The orbit adjust system compensated for the decay. It consisted of a cluster of small rockets, known as drag makeup units, which were fired individually and at selected intervals. Each firing accelerated the vehicle slightly, boosting it back into approximately its original orbital altitude.

The following is a summary of the most mysterious CORONA J-1, two bucket mission ever flown. Program flight number 78 (Mission 1005) was launched on 27 April 1964. The launch and insertion into orbit were uneventful. The Master Panoramic camera operated satisfactorily through the first bucket, but the Slave Panoramic camera failed after 350 cycles when the film broke. Then the AGENA power supply failed. Vandenberg transmitted a normal recovery enable command on southbound revolution 47 on 30 April. The vehicle verified receipt of the command, but nothing happened. The recovery command was repeated from various control stations, in both the normal and backup LIFEBOAT recovery modes, on 26 subsequent passes extending through 20 May. The space vehicle repeatedly verified that it had received the commands, but the ejection sequence did not occur. No further recovery commanding was attempted after the 20th since the vehicle had ceased on the 19th to acknowledge receipt. It was felt by the systems control technicians that Mission 1005 space hardware was doomed to incineration. The vehicle would gradually sink into a progressively lower orbit until it finally entered the atmosphere and exploded.

25X1

However, it didn't happen quite that way. A commercial photographer named Leonardo Davila telephoned the American Embassy in Caracas on 1 August 1964 to report that he had photographed a space satellite that had fallen in Venezuela. The report started a series of inquiries that discovered, after the fact, what had happened to Mission 1005.

At six minutes past midnight on the morning of 26 May, coinciding with northbound revolution 452 of Mission 1005, observers in Maracaibo, Venezuela, saw five incendiary objects in the sky. Seven minutes later, the Moorestown, New Jersey, SPADATS station made radar sightings of small residual objects in the atmosphere. The DEW line made three radar hits on objects of unknown size. The [redacted] tracking station did not detect the Mission 1005 vehicle on revolution 452. 25X1 NRO

On 7 July, 14 year old Eladio Becerra and 40 year old Gabino Mora stumbled upon a battered, glimmering gold object lying on nearly deserted mountainous terrain within a couple of miles of the Colombian border and near the village of La Fria in Tachira State in southwestern Venezuela. The object was on Farm No. 35 owned by Pablo Garcia, but Becerra and Mora worked for Facundo Albarracin, the owner of neighboring Farm No. 36. They reported their find to their employer. He had the object moved about 1,000 yards onto his own property and then sent out word of the find in an attempt to sell the object. However, it being an unknown object in terms of value, Albarracin could not even get a worthwhile offer to have it smuggled into nearby Colombia. So Albarracin and his employees commenced to dismantle the bucket. By hacking and prying, they managed to remove the radio transmitter and various pieces of the takeup assembly using them as household utensils and as toys for the children.

Before long, word of the find reached the city of Cristobal, and people began visiting La Fria to examine the curious object from space. It was the first bucket from Mission 1005 with one full spool of well charred film clearly visible. One of the visitors was the photographer, Davila, who passed the word to the American Embassy. Military attachees were called in and a team of CORONA Program officers flew to Caracas to direct the recovery operation and to ship the capsule and any other fragments that could be found back to the United States for detailed examination. The capsule was carried out part way by campesinos on foot and then was taken over by the Venezuelan Defense Ministry and flown to Caracas. The USAF bought the crumpled specimen from the Venezuelan Government and quietly dismissed the event as an unimportant NASA space experiment that had gone astray.

25X1

The story rated only a dozen lines in the New York Times of August fifth, but the local Venezuelan press had a field day. Diario Catolico, of San Cristobal, along with a lengthy report, published three pictures of the capsule showing the charred roll of film on the takeup spool. The photographs are reproduced in Figure 8-1. The Daily Journal handled the story in lighter vein with this parody of Longfellow:

> I shot an arrow into the air.
> It fell to earth I know not where.
> Cape Kennedy signalled: "Where is it at, you are?"
> Responded the rocket: "La Fria,Tachira."

Many of the bits and pieces that appeared in the first on-the-scene photographs, as well as other items that were known to be in the capsule, were kept by those who had handled it.

The CORONA technicians who examined the capsule after its arrival back in the U. S. concluded that the re-entry of the SRV came as a result of normal orbit degeneration with separation from the instrument fairing being caused by re-entry forces. The thrust cone was sheared during separation but was retained by its harness long enough to act as a drogue chute, thus preventing the capsule from burning up during re-entry and stabilizing it for a hard, nose-down landing.

The final major modification of the CORONA system got under way in the spring of 1965 at a time when about a dozen and a half of the two bucket J-1 systems had been flown. The J-1 was performing superbly, but had little potential for future system growth. The new CORONA improvement program was begun with a series of meetings among representatives of Lockheed, General Electric, Itek, and the various CORONA Program offices to examine ways of bettering the performance of the panoramic and Stellar/Index cameras and of providing a more versatile command system. These were the resulting design goals established for a new panoramic camera:

A. Improved photographic performance by removal of camera system oscillating members and reduction of vibration from other moving components.

B. Improvement of the velocity-over-height match to reduce image smear.

C. Improved photographic scale by accommodation of proper camera cycling rates at altitudes down to 80 nm (the minimum J-1 operating altitude was 100 nm).

D. Elimination of camera failures caused by film pulling out of the guide rails (an occasional problem with the J-1 system).

E. Improved exposure control through variable slit selection (the J-1 system had a single exposure throughout the orbit resulting in poor performance at low sun angles).

F. Capability of handling alternate film types and split film loads (an in-flight changeable filter and film change detector were added for this purpose).

25X1

NEW YORK TIMES PHOTOS OF MISSION 1005

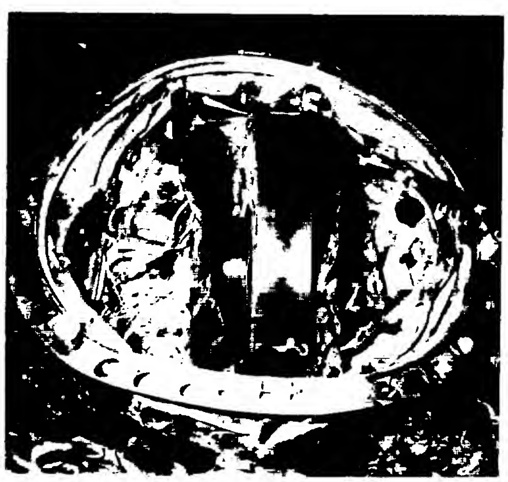
MISSION 1005

I shot an arrow into the air, it fell to earth- I know not where.....

Cape Kennedy signalled: "Where is it at, you are?" -

Responded the Rocket: "La Fria, Tachira."

SRV being carried out of La Fria on foot by Campesinos.



On location in La Fria, Tachira.

Sold to the U. S. Air Force

Figure 8-1

G. Capability of handling ultra thin base (UTB) film (yielding a 50% increase in coverage with no increase in weight).

The panoramic camera that was developed to meet those design goals was known as the "constant rotator." The predecessor C''' camera employed a combination of rotating lens cell and reciprocating camera members. In the constant rotator, the lens cell and the balance of the camera's optical system are mounted in a drum. The entire drum assembly is continuously rotated, thus eliminating the reciprocating elements from the camera system. The film is exposed during a 70 degree angular segment of the drum's circular sweep. The capability of using UTB was one of the design goals, but the camera design was not to be constrained by requirements to accommodate the thinner film. UTB was successfully flown on several other missions, but ground test results showed a loss of reliability and attempts to use it in the constant rotator were eventually abandoned. In all other respects, however, the constant rotator was a resounding success. It yielded substantially better ground resolution in the photography, the best resolution being approximately 4.5 feet. It also permitted versatility in operation far exceeding that available in the earlier cameras.

The Stellar/Index camera in use was a delicate instrument with a short 1.5 inch focal length and a history of erratic performance. The efforts at upgrading the performance of the Stellar/Index camera resulted in an instrument with a 3 inch focal length (like ARGON) and a dual-looking stellar element. The new camera had the designation of Dual Improved Stellar Index Camera, commonly referred to by its acronym DISIC.

The new payload system, which was designated the J-3, consisted of a pair of constant rotator Panoramic cameras, a pair of Horizon cameras, and a DISIC. During the study phases, an interim configuration between J-1 and J-3 was included which consisted of a combination of the J-1 Panoramic camera and the DISIC mapping camera on an improved THORAD booster. This interim system, designated J-2, was never implemented. However, the J-3 designers continued to label their work as J-3, even after the J-2 configuration was dropped. Hence, there was no operational J-2 program as the series jumped from J-1 to J-3. The J-3 system retained the stereo capability begun with the MURAL cameras and the two bucket recovery concept of the J-1. Apart from the improved photographic capability of the hardware itself, the most significant advance represented by the J-3 was in the flexibility it allowed in command and control of camera operations. Any conventional area search photographic reconnaissance system is film limited. Consequently, the ultimate goal of all of the CORONA improvement efforts was to fly the maximum load of the best quality film at optimum acquisition parameters. The built-in flexibility of the J-3 system greatly increased the variety and degree of controls that could be applied to camera operations, thus substantially boosting the potential intelligence content of the photography.

25X1

The first J-3 system was launched on 15 September 1967. This mission yielded even better photographic intelligence and higher operational reliability than its successful predecessor, the J-1 system. Figure 8-2 shows the succession of CORONA developments with profiles of all of the various CORONA payloads. Figure 8-3 provides a photograph of the camera systems.

A series of important tests were run in conjunction with the primary mission of the first five J-3 system flights. These secondary objectives were the culmination of efforts requested by the United States Intelligence Board (USIB), which in February 1966 directed CIA to develop techniques that would enable estimates of crop yields to be made from satellite photography. To accomplish this requirement, the payloads of these five J-3 systems were specially instrumented and contained, in some cases, tag-on lengths of special camouflage detection color film or high speed, high resolution black and white film. The test series demonstrated the J-3 camera's capability to handle new photographic techniques due to the added flexibility of having two changeable filters and four changeable exposure slits on each camera. This allowed the use of mixed film loads and/or different filters. These tests were conducted without degrading the main intelligence collection mission in any way.

These tests drew such interest throughout the intelligence community that a CORONA J-3 Ad Hoc Committee was formally convened by the Director National Reconnaissance Office (DNRO) on 4 December 1967 and formally constituted in February 1968. Its purpose was to analyze and evaluate the experiments conducted on these five test flights. Specific findings of the Committee included the recommendations that: (1) further testing of color films and techniques should be conducted against specific intelligence requirements; (2) a special subcommittee of the Committee on Imagery Reconnaissance and Exploitation (COMIREX) should be constituted to evaluate the utility of satellite color photography; and (3) a well planned color collection program be worked out with the close cooperation of the system program offices, the Satellite Operations Center (SOC), the intelligence analysts, and the photointerpreters.

While the primary objective of the CORONA Program was the search and surveillance of denied territories, the high quality of the photography permitted even further exploitation of the film. For example, an effort at Itek was undertaken by the Government and private agencies to achieve photogeological mapping from the satellite photography. Through stereoscopic viewing of the high definition black and white and color films, these studies at Itek did lead to successful geological mapping. In March 1971, Itek published W. V. Trollinger's final report, Appraisal of Geologic Value for Mineral Resources Exploitation, which concluded that CORONA system image quality was sufficient for most photogeologic mapping projects, and that the film could be used in determining the geological, economical, and political potential of a photographed area. Figure 8-4 provides a stereo pair (one black and white record and one color record) from a mission showing apparent mineralization. Figure 8-5 is a photogeologic evaluation map produced from CORONA imagery.

25X1

There were many officers and technicians in the Air Force and CIA responsible for the success of the CORONA Program. As noted earlier Captain Mitchell and his crew were decorated for their part in the aerial recovery of DISCOVERER XIV. Other key Air Force personnel received service recognition, but because of security considerations it was not possible for the awards to be made directly for contributions to the CORONA Program. The CIA had a provision within its honors and merit program to present classified awards to its employees. They did not present any medals for their work in the early CORONA development. CIA did, however, award recognition to their members on the CORONA design team who had been significant contributors in making the J-1 and J-3 systems a success. Kenneth M. Tebo, A. Roy Burks, and Vernard Webb were recipients of the Intelligence Medal of Merit; and Louis A. Snyder, Donald Grass, and Donald Cochran were awarded the Certificate of Merit.

SECTION IX

SUMMARY

Looking back on CORONA, it is not always easy to keep in mind that it was merely an assemblage of inanimate objects designed and put together to perform a mechanical task. The program began as a short term interim system, suffered through adversity in its formative years, and then survived in glory throughout a decade. Those who were associated with CORONA or came to depend upon its product developed a personal affection for this program. They suffered with it in failure and revelled in its successes.

The technological improvements engineered under CORONA advanced the system in eight years from a single panoramic camera system having a design goal of 20 to 25 feet ground resolution and an orbital life of one day, to a twin camera panoramic system producing stereophotography at the same ground resolution. From this point, it became a dual recovery system with an improvement in ground resolution to approximately 7 to 10 feet with twice the film load, to finally the J-3 system with a constant rotator camera, selectable exposure and filter controls, planned orbital life of 18 to 20 days, and yielding nadir resolution of 5 to 7 feet.

The totality of CORONA's contributions to US intelligence holdings on denied areas and to the US space program in general is virtually immeasurable. Its progress was marked by a series of notable firsts: (1) the first to recover objects from orbit; (2) the first to deliver intelligence information from a satellite; (3) the first to produce stereoscopic satellite photography; (4) the first to employ multiple re-entry vehicles; and (5) the first satellite reconnaissance program to pass the 100+ mission mark. By March 1964, CORONA had photographed 23 of the 25 Soviet ICBM complexes then in existence; three months later it had photographed all of them. The value of the CORONA derived intelligence effort is given dimension by this statement in a 1968 intelligence report: "No new ICBM complexes have been established in the USSR during the past year." This statement was made because of the confidence held by the analysts that if an ICBM was there, then CORONA photography would have disclosed them.

CORONA coverage of the Middle East during the June 1967 war was of great value in estimating the relative military strengths of the opposing sides. Evidence was produced of the extensive damage inflicted by the Israeli air attacks by actual count of aircraft destroyed on the ground in Egypt, Syria, and Jordan. The claims of the Israelis might otherwise have been discounted as exaggerations but for this timely photographic proof.

Again in 1970, CORONA was called on to provide proof of Israeli-Egyptian claims with regard to ceasefire compliance or violation. CORONA Mission 1111, launched on 23 July 1970, successfully carried out the 25X1 NRO

to our allies, would doubtless have been increased by billions. The cost for all CORONA activities of ARPA, the Air Force, and CIA over the 16 year period was [redacted] A graphical synopsis of the CORONA Program history reflecting the number of launches and developmental and operational milestones is given in Figure 9-2, and a detailed history of each of the 145 CORONA vehicles is recorded in Table 9-1 on pages 9-8 thru 9-16. 25X1 NRO

The CORONA Program had to be extended because of delays in the follow-on system; hence even qualification models were refurbished and flown. As a result, there was little hardware available at the 25X1

Ileme.
Out to
LMSC
9-3

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

Figure 9-2

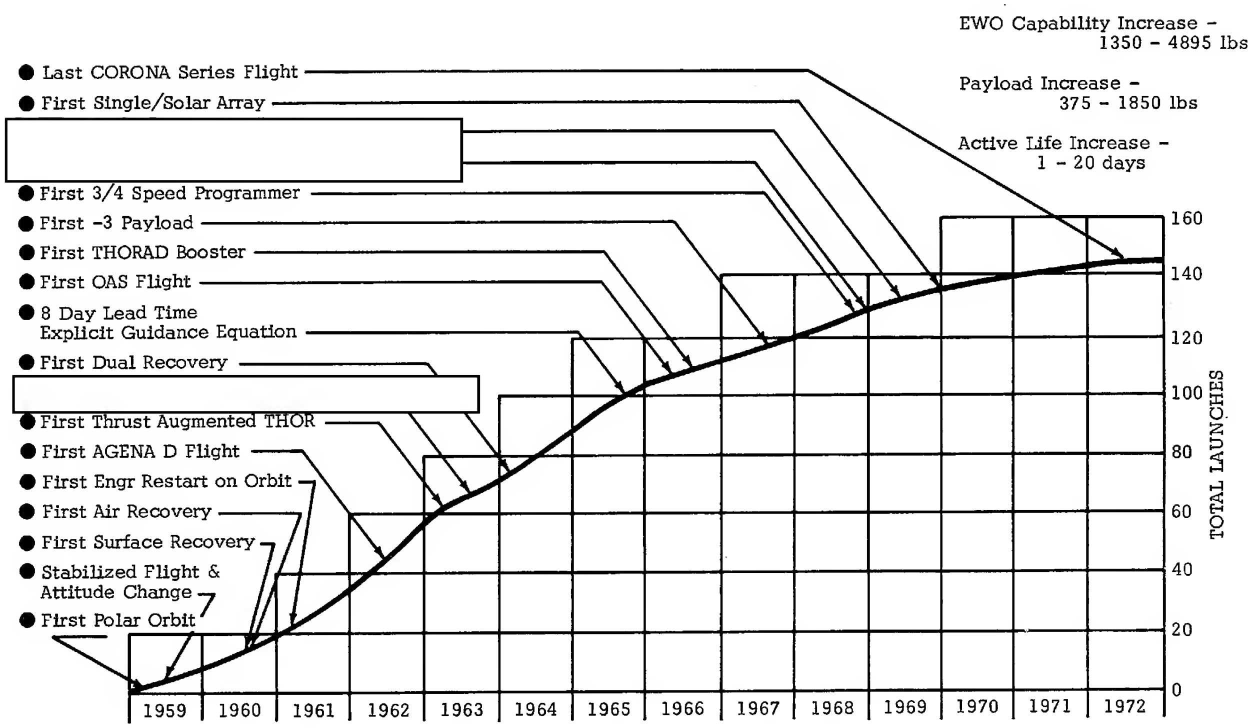
TOP SECRET

25X1
NR
O

25X1
NR
O

25X1

CORONA PROGRAM SYNOPSIS



	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Launches	8	11	17	22	17	15	14	9	9	8	6	4	3	2
Recoveries	0	4	7	16	12	23	25	16	18	16	12	8	4	4

TOP SECRET

termination of the program when it was suggested that a museum display be set up to illustrate and to preserve the CORONA Program. Using recovered hardware from the last flight, development models from the J-3 program, and photographic records from the memorable flights, a classified museum display was set up in Washington, DC. Figures 9-3 and 9-4 provide photos of the museum display and photos of some of those who attended and participated in the dedication. In his speech dedicating the Museum, Mr. Richard Helms, the Director of Central Intelligence, said:

> "It has been confidence in the intelligence estimates that has allowed President Nixon to enter into the Strategic Arms Limitation Talks and to sign the Arms Limitation Treaty this month. There can be no doubt that the photo reconnaissance satellite represents the primary means of verification for SALT, or that CORONA, the program which pioneered the way in satellite reconnaissance, deserves the place in history which we are preserving through this small Museum display.
>
> "A Decade of Glory as the display is entitled, must for the present remain classified. However, as the world grows to accept satellite reconnaissance, we hope it can be transferred to the Smithsonian Institute where the American public can view the work and the men of CORONA, and like the Wright Brothers, can be recognized for the role they played in the shaping of history."

25X1

[redacted]

2
Illust.
sent to
LMSC
9-6,
9-7

TOP SECRET

TABLE 9-1

CORONA PROGRAM PERFORMANCE

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
1	1022	163																	2/28/59				No capsule flown.
2	1018	170			B10														4/13/59				Capsule ejected over Spitzenbergen 4/13/59.
3	1020	174			B10														6/3/59				AGENA failed to orbit.
4	1023	179	002	9001	C	4	102							5/5/59	5/29/59	3 - 3	7 - 2	16	6/25/59	0			AGENA failed to orbit.
5	1029	192	004	9003	C	7	111							6/5/59	7/23/59	6 - 6	9 - 6	20	8/13/59	0.405			Low temperatures. Not recovered. Instrument failed on Rev 1.
6	1028	200	003	9002	C	6	105							5/18/59	6/3/59	2 - 2	13 - 2	16	8/19/59	0.108			Retrorocket malfunction. Not recovered. Instrument failed on Rev 2.
7	1051	206	006	9004	C	10	109							6/24/59	7/23/59	4 - 1	19 - 3	10	11/7/59	0			AGENA failure. No orbit.
8	1050	212	007	9005	C	9	107							7/25/59	11/7/59	15 - 0	16 - 6	10	11/20/59	0			Eccentric orbit. Wrong altitude. Instrument failure. Not recovered.
9	1052	213	008	9006	C	8	113							6/28/59	1/10/60	28 - 0	31 - 4	10	2/4/60	0			AGENA failed to orbit.
10	1054	223	009	9007	C	13	110							12/7/59	2/4/60	8 - 3	10 - 4	10	2/19/60	0			AGENA failed to orbit.
11	1055	234	010	9008	C	14	103							1/11/60	2/24/60	6 - 2	13 - 3	16	4/15/60	16			Spin rocket failure. Not recovered. Instrument operation OK.
12	1053	Diagnostic	014	N/A	N/A														6/29/60	0			AGENA failed to orbit. Diagnostic.
13	1057	Diagnostic	012	N/A	N/A														8/10/60	0		8/11/60	Successful water pickup. Diagnostic.
14	1056	237	011	9009	C	3	101							1/28/60	3/28/60	8 - 4	29 - 0	20	8/18/60	20		8/19/60	Successful air catch. Instrument operation OK.
15	1058	246	013	9010	C	11	106							2/22/60	8/25/60	26 - 3	29 - 1	20	9/13/60	20			Vehicle pitch attitude improper at re-entry. Capsule sunk before recovery. Instrument operation OK.
16	1061	253	015	9011	C'	15	506							6/6/60	9/17/60	14 - 5	20 - 2	20	10/26/60	0			"D" timer malfunction AGENA failed to orbit.
17	1062	297	016	9012	C'	17	507							9/12/60	10/17/60	5 - 0	9 - 6	39	11/12/60	1.7 leader		11/14/60	Successful air catch. Payload broke. TM No. 34.
18	1103	296	017	9013	C'	19	508							10/9/60	10/29/60	2 - 6	8 - 3	39	12/7/60	39		12/10/60	Successful air catch. Instrument operation OK. TM No. 37.
19	1101	258	N/A	N/A	N/A	N/A	N/A												12/20/60	0			No SRV installed (RM-1 payload).
20	1104	298	018	9014A	A	3	520							10/18/60	10/21/60	9 - 1	17 - 3	39	2/17/61	39			Orbital programmer failed at Rev 31. Instrument failed. Still in space. No shutter firings.
21	1102	261	N/A	N/A	N/A	N/A	N/A												2/18/61	0			No SRV installed (RM-2 payload).
22	1105	300	019	9015	C'	18	509							2/21/61	3/28/61	5 - 0	5 - 2	39	3/30/61	0			AGENA failure. No orbit. TM No. 39.
23	1106	307	020	9016A	A	4	521							11/30/60	3/16/61	15 - 1	18 - 3	39	4/8/61	39			Recovery was attempted on Rev 31 due to loss of control gas. Still in space. Instrument operation OK.
24	1108	302	022	9018A	A	8	541							4/3/61	5/25/61	7 - 3	9 - 3	39	6/8/61	0		No orbit	AGENA failure, power failure, and guidance problem causing ocean impact.
25	1107	306	021	9017	C'	16	510							3/7/61	4/17/61	5 - 6	14 - 3	39	6/16/61	39		6/18/61	Successful water pickup.

TOP SECRET

25X1

25X1

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

TOP SECRET

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
26	1109	308	023	9019	C'	20	511							10/18/60	5/15/61	29 - 6	37 - 3	39	7/7/61	28.78		7/9/61	Successful air catch. Instrument failed on Rev 22 .
27	1110	322	024	9020A	A	7	524							4/4/61	6/24/61	11 - 3	15 - 3	39	7/21/61	0			No orbit. THOR guidance destruct.
28	1111	309	025	9021	C'	21	512							11/13/60	5/20/61	26 - 6	37 - 3	39	8/3/61	0		No orbit	AGENA guidance failure.
29	1112	323	027	9023	C'''	54	554							6/23/61	8/17/61	7 - 6	9 - 5	39	8/30/61	39		9/1/61	Recovery on Rev 32 . Instrument OK.
30	1113	310	026	9022	C'''	53	551							5/29/61	7/17/61	7 - 0	15 - 1	39	9/12/61	39		9/14/61	Successful air catch. Recovery OK Rev 33.
31	1114	324	029	9024	C'''	55	552							5/22/61	8/23/61	13 - 2	16 - 5	39	9/17/61	20		No Separation	Successful orbit. Power failure before recovery precluded the event. Instrument OK (Instr quit at 400 cycle failure).
32	1115	328	032	9025	C'''	56	555							8/9/61	9/14/61	5 - 1	9 - 2	39	10/13/61	12.4		10/14/61	Successful air catch. Suspect AGENA power problems had to attempt recovery on Rev 18.
33	1116	329	028	9026	C'	22	513							3/16/61	7/20/61	18 - 0	31 - 4	39.5	10/23/61	0		No orbit	Second stage AGENA failed. Went into SFA after take-off.
34	1117	330	033	9027	C'	24	553							5/22/61	9/26/61	18 - 1	23 - 6	39	11/5/61	39			Successful orbit. Due to gas valve failure, no recovery made. Still in space. Instrument operation OK.
35	1118	326	037	9028	C'	25	523							8/30/61	10/18/61	7 - 0	11 - 0	39	11/15/61	13		11/16/61	One day operation due to shortage of control gas. Instrument operation OK. Recovery bucket re-used.
36	1119	325	039	9029	C'''	52	525							11/10/61	11/27/61	2 - 3	4 - 4	38.2	12/12/61	38.2		12/16/61	Successful orbit recovered on Rev 64 . Successful water pick-up. Instrument operation OK.
37	1120	327	040	9030	C'''	57	571							11/16/61	12/19/61	4 - 5	8 - 2	38.6	1/13/62	0			AGENA failure. No orbit.
38	1123	241	041	9031	Cm-1	70-71	581	57	74	N/A	N/A	70-71	7	1/3/62	2/16/62	6 - 2	7 - 6	37.6-37.5	2/27/62	75.1	65	3/3/62	Successful orbit. Ablative shield recovered intact. Air snatched. Instr OK. F/C failed full spools of payload.
39	1124	331	042	9032	Cm-2	72-73	584	53	NONE	N/A	N/A	72-73	1	1/5/62	4/5/62	12 - 6	14 - 4	38.4-37.8	4/17/62	45.0	33	4/20/62	Successful orbit air catch. Instrument operation OK. Guidance system operation OK.
40	1125	333	043	9033	Cm-3	74-75	586	52	70	N/A	N/A	74-75	6	1/26/62	4/11/62	10 - 5	13 - 1	39.1-39.1	4/28/62	68.8	64		Successful orbit. Oper malfunction on orbital timer failed to eject chute. Chute ejector squibs failed. Sunk.
41	1126	334	044	9034	A-5	A	582	58	N/A	N/A	N/A	N/A	13	5/26/61	4/25/62	47 - 4	50 - 3	39.4	5/15/62	39.4	63	5/19/62	Successful air recovery. Bellows missing H-timer and shutter timer malfunction. Instr oper OK except this.
42	1128	336	045	9035	Cm-4	76-77	585	55	82	N/A	N/A	76-77	9	2/16/62	5/13/62	12 - 2	14 - 4	39.7-39.5	5/29/62	79.2	49	6/1/62	Successful air recovery. No F/C oper. Chute strap burned off 200 miles off location due to comm'd dump sequence.
43	1127	335	046	9036	Cm-5	78-79	583	44	76	N/A	N/A	78-79	8	3/1/62	5/21/62	11 - 4	13 - 1	40.6-40.5	6/1/62	81.1	0		Successful orbit. Chute tore loose SRV went into ocean, floated for 3 minutes then sank. Instr oper OK.
44	1129	339	047	9037	Cm-6	80-81	591	48	88	N/A	N/A	84-85	10	3/21/62	5/30/62	10 - 0	13 - 2	40.1-40.2	6/22/62	60.3	50	6/25/62	Successful air recovery. Chute cords intact. Air snatch at 12,000 ft on first pass. No known malfunctions.
45	1151	340	048	9038	Cm-7	84-85	592	50	80	N/A	N/A	96-97	3	3/20/62	6/13/62	12 - 1	14 - 2	40.1-39.9	6/27/62	80.0	63	7/1/62	Successful air recovery. First AGENA "D" burned too long causing 3 minutes high on period. Instr oper OK. F/C bad.
46	1130	342	049	9039	Cm-8	90-91	593	59	90	N/A	N/A	88-89	13	4/11/62	6/20/62	10 - 0	14 - 2	40.2-40.2	7/20/62	19.7	33	7/22/62	Successful air recovery thru normal sequence. F/C full. H-timer malfunction. Instr oper only 14%.
47	1131	347	050	9040	Cm-9	82-83	594	56	86	N/A	N/A	86-87	16	4/19/62	7/3/62	10 - 5	14 - 1	39.4-39.3	7/27/62	78.7	65	7/31/62	Successful air recovery. Instrumentation OK. F/C failed due possibly to metering switch and solenoid quitting.
48	1152	344	051	9041	Cm-10	88-89	595	60	94	N/A	N/A	94-95	5	4/30/62	7/17/62	11 - 1	13 - 2	39.5-39.4	8/1/62	78.9	65	8/5/62	Successful air recovery through normal sequence. Instr oper OK. F/C full.
49	1153	348	052	9044	Cm-11	92-93	596	58	84	N/A	N/A	102-103	19	5/19/62	8/24/62	13 - 6	14 - 3	39.4-39.3	8/28/62	78.7	65	9/1/62	Successful air recovery through normal sequence. Instr oper OK. F/C didn't function properly.
50	1132	349	054	9042	A-10	A	600	63	N/A	N/A	N/A	N/A	202	6/22/62	8/6/62	6 - 3	10 - 1	36.3	9/1/62	36.3	65		Successful instr oper planned to recover after 65th Rev but chute tore from SRV during air P/U. No F/C flown.

TOP SECRET

25X1

25X1

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
51	1133	350	055	9043	Cm-12	94-95	597	65	100	N/A	N/A	98-99	4	5/16/62	9/1/62	15 - 3	17 - 5	40.2-40.2	9/17/62	44.2	17	9/18/62	Successful air recovery. No P/L on F/C 100 mile perigee and radiation factor involved. Instr oper OK.
52	1154	351	056	9045	Cm-13	96-97	598	64	D-3	N/A	N/A	104-105	11	6/20/62	9/13/62	12 - 1	14 - 3	39.6-39.5	9/29/62	66.0	49	10/2/62	Successful air recovery. F/C full. Water seal on main instr side failed to close. P/L not cut. Part of P/L in W/S/
53	1134	352	057	9046	A-9	A	603	66	N/A	N/A	N/A	N/A	10	3/31/62	9/30/62	26 - 1	27 - 3	38.3	10/9/62	38.3	65	10/13/62	Successful air recovery. Veh was 70 miles out of apogee. Intended for 170, went 242 miles. Shutter timer malfunct.
54	1401				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10/26/62	N/A	N/A		Deep probe radiation.
55	1136	367	058	9047	Cm-14	98-99	599	54	D-5	N/A	N/A	106-107	24	6/25/62	10/23/62	17 - 1	19 - 0	39.8-39.6	11/5/62	79.4	65	11/9/62	Successful air recovery. F/C full. Instrument operation perfect.
56	1135	353	059	9048	Cm-15	100-101	601	62	D-7	N/A	N/A	100-101	23	7/10/62	11/12/62	17 - 6	19 - 4	39.4-39.4	11/24/62	78.8	81	11/29/62	Successful air recovery. F/C failed. Instr oper OK. Picked up capsule 32 miles from Honolulu.
57	1155	361	060	9049	Cm-16	86-87	606	56	D-2	N/A	N/A	116-117	17	9/19/62	11/24/62	9 - 3	10 - 6	39.6-39.9	12/4/62	67.0	0		Successful orbit during air snatch. Skyhook tore part of chute causing SRV to sink. 2 day orbit due to 80 mi perigee.
58	1156	368	061	9050	Cm-17	102-103	607	70	D-4	N/A	N/A	114-115	18	8/13/62	12/7/62	16 - 4	17 - 4	39.7-39.6	12/14/62	79.3	64	12/18/62	Successful air recovery. S/I unit full. Instrument operation OK.
59	1157	369	063	9051	Cm-18	104-105	608	69	D-8	N/A	N/A	108-109	21	10/23/62	12/20/62	8 - 2	10 - 6	39.1-39.0	1/7/63	78.1	64	1/11/63	Successful water pick up. Instr oper OK 1,000 mi off location. AGENA pitch. Both antennas burned in half.
60	1159	370	064	9052	Cm-20	108-109	610	67	D-6	N/A	N/A	120-121	12	12/8/62	2/13/63	9 - 3	12 - 1	39.3-39.5	2/28/63	0	0		First TAT. Third TAT booster failed to separate. Destruct 100 seconds after launch.
61	1164	360	065	8001	L-1	03	612	70	S-2	T/L-1	N/A	6	303	11/27/62	3/5/63	14 - 0	15 - 6	72.2	3/18/63	0	0		Second TAT worked perfectly. No orbit due to failure of pneumatic guidance on Agena booster.
62	1160	376	066	9053	Cm-19	106-107	609	60	D-10	N/A	N/A	118-119	22	9/21/62	2/25/63	22 - 3	27 - 2	38.8-38.8	4/1/63	66.7	49	4/4/63	Successful air recovery. Had to recover after 49 revs. AGENA pwr supply prob. 400 cycle inverter failed. Instr OK.
63	1411	372	067	9055	A-12	A	605	54	N/A	N/A	N/A	N/A	205	1/10/63	4/10/63	12 - 6	15 - 1	38.3	4/26/63	0	0		No orbit acheived. Attitude sensors misaligned. Perfect launch.
64	1165	364	069	8002	L-2	05	613	58	S-3	T/L-2	N/A	4	302	2/26/63	4/14/63	6 - 5	11 - 4	72.9	5/18/63	0	33	5/20/63	Decoder 103 no activate. Signal erratic. Orbit AGENA boost too strong. D-timer 4 sec slow. Recovery after 33 revs.
65	1161	362	068	9054	M-21	112-113	616	68	D-9	N/A	N/A	110-111	26	12/7/62	4/13/63	18 - 1	26 - 5	39.5-39.2	6/12/63	78.7	65	6/16/63	
66	1166	381	070	9056	M-22	110-111	611	62	D-11	N/A	N/A	130-131	20	4/15/63	6/1/63	6 - 5	10 - 2	39.5-39.4	6/26/63	78.9	65	6/30/63	
67	1412	388	071	9057	M-23	120-121	624	55	D-12	T/U-12	N/A	128-129	14	5/1/63	6/16/63	6 - 4	11 - 2	39.1-39.1	7/18/63	78.2	64	7/22/63	Successful air recovery. Lost center format closure on slave unit. Temperature in orbit was in mid 80s.
68	1167	382	072	8003	L-3	01	614	66	S-4	T/L-6	N/A	7	304	3/7/63	7/8/63	17 - 4	20 - 5	79.1	7/30/63	19.8	32	8/1/63	Successful air recovery. Instrument operation only through Rev 23. Instrument malfunction.
69	1162	377	073	1001	J-1A	114-115	615	65	D-14	T/U-13	S/C-3	T-5	402	4/1/63	8/3/63	17 - 5	20 - 5	81.5	8/24/63	81.5	64	8/28/63	Successful air recovery. S/I failure. First J system flown. Main instrument operation OK.
	1162	377	073	1001	J-1B	114-115	617	01	D-16	T/U-10	S/C-3	T-4	402	4/1/63	8/3/63	17 - 5	20 - 5	81.5	8/24/63	0	0		Tried recovery after 12 days. 400 cycle inverter on AGENA failed. S/I Intermittent. Temp gen showed veh hot.
70	1169	394	074	9058	A-11	A	604	64	N/A	N/A	N/A	N/A	203	9/3/62	8/2/63	47 - 5	51 - 4	38.9	8/29/63	38.9	65	9/2/63	Successful air recovery. Instrument operation perfect.
71	1163	383	075	1002	J-2A	116-117	619	69	D-18	T/J-4	S/C-4	T-3	404	4/24/63	8/27/63	17 - 6	21 - 5	81.7	9/23/63	81.0	49	9/26/63	Successful air recovery. Master unit on cassette failed. Misadjustment on puck arm. Consistent light leaks.
	1163	383	075	1002	J-2B	116-117	620	60	D-13	T/J-13	S/C-4	T-6	404	4/24/63	8/27/63	17 - 6	21 - 5	82.5	9/23/63	0	165		Tried to recover on Rev 165 but commands failed. Decoder failure in vehicle.
72	1601	386	079	9059	A-6	A	602	50	N/A	N/A	N/A	N/A	204	2/21/61	10/8/63	136 - 6	139 - 6	40.1	10/29/63	40.1	65	11/3/63	Successful air recovery. Perfect instr oper. Best "A" system flown to date. Discontinuities three times on DRCG.
73	1171	400	078	9060	M-24	128-129	632	48	D-27	T/J-12	N/A	T-23	504	8/10/63	10/30/63	11 - 4	13 - 0	78.7	11/9/63	0	0		System became unstable 90 seconds after launch.

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
74	1172	406	080	9061	M-25	134-135	637	75	D-26	T/J-21	N/A	T-29	25	9/27/63	11/18/63	7 - 4	8 - 5	37.9-37.8	11/27/63	75.7	81		Tried to recover after 81 revolutions (4 days) but capsule did not eject properly.
75	1168	398	081	9062	M-26	130-131	642	61	D-34	T/J-10	N/A	T-24	306	10/24/63	11/27/63	4 - 6	8 - 2	38.4-38.6	12/21/63	77.0	81	12/26/63	Successful air recovery. Perfect instrument operation.
76	1174	389	084	1004	J-5A	124-125	629	64	D-29	T/U-20	S/C-7	T-39	505	6/25/63	2/1/64	31 - 4	33 - 4	79.0	2/15/64	79.0	49	2/18/64	Successful air recovery. Instrument operation very good.
	1174	389	084	1004	J-58	124-125	628	65	D-42	T/J-6	S/C-7	T-10	505	6/25/63	2/1/64	31 - 4	33 - 4	79.2	2/15/64	79.2	112	2/22/64	Successful air recovery. Instrument operation good.
77	1175	396	088	1003	J-6A	126-143	631	105	D-36	T/J-17	S/C-8	T-17	506	7/26/63	3/6/64	32 - 0	34 - 4	78.7	3/24/64	0	0		No orbit due to AGENA failure (regulated power failure).
	1175	396	088	1003	J-6B	126-143	630	103	D-31	T/J-18	S/C-8	T-18	506	7/26/63	3/6/64	32 - 0	34 - 4	78.9	3/24/64	0	0		Did not achieve orbit.
78	1604	395	093	1005	J-8A	146-147	618	120	D-28	T/J-24	S/C-10	T-15	513	1/16/64	4/10/64	12 - 0	14 - 3	78.4	4/27/64	0	0		Successful launch & orbit. No power from AGENA due to pyro buss failure. Slave instr failed due to film breakage.
	1604	395	093	1005	J-8B	146-147	635	121	D-40	T/J-26	S/C-10	T-26	513	1/16/64	4/10/64	12 - 0	14 - 3	78.4	4/27/64	0	0		
79	1176	403	094	1006	J-9A	148-149	638	107	D-45	T/J-14	S/C-11	T-21	508	1/27/64	4/26/64	12 - 5	18 - 2	78.5	6/4/64	78.5	65	6/8/64	Successful air recovery. Second door stuck for 2 orbits. Instrument operation good.
	1176	403	094	1006	J-9B	148-149	639	104	D-49	T/J-30	S/C-11	T-30	509	1/27/64	4/26/64	12 - 5	18 - 2	78.5	6/4/64	78.5	128	6/12/64	Successful air recovery. Instrument operation good.
80	1606	408	096	9065	A-21	21	661	61	N/A	N/A	N/A	N/A	525	3/5/64	6/2/64	12 - 5	14 - 2	39.6	6/13/64	39.6	96	6/19/64	Successful air recovery. Instrument operation good. Cloud coverage 60-70%.
81	1609	410	095	1007	J-7A	144-145	634	102	D-43	T/J-11	S/C-9	T-11	509	12/30/63	5/13/64	19 - 1	24 - 3	80.1	6/19/64	80.1	65	6/23/64	Successful air recovery. Instrument operation good. Resolution good.
	1609	410	095	1007	J-7B	144-145	633	110	D-54	T/J-16	S/C-9	T-16	509	12/30/63	5/13/64	19 - 1	24 - 3	78.9	6/19/64	78.9	128	6/27/64	Successful air recovery. Instrument operation good.
82	1177	404	097	1008	J-10A	150-151	640	109	D-48	T/J-15	S/C-12	T-31	514	2/27/64	5/19/64	11 - 4	19 - 0	80.1	7/10/64	80.1	49	7/13/64	Successful air recovery. Instrument operation good.
	1177	404	097	1008	J-10B	150-151	641	112	D-33	T/J-9	S/C-12	T-14	514	2/27/64	5/19/64	11 - 4	19 - 0	80.2	7/10/64	80.2	112	7/17/64	Successful air recovery. Instrument operation good.
83	1605	413	098	1009	J-12A	154-155	646	136	D-56	T/U-23	S/C-15	T-37	517	3/30/64	6/26/64	12 - 4	18 - 2	79.2	8/5/64	69.5	49	8/8/64	Successful air recovery. Instrument operation good. AGENA beacon problem.
	1605	413	098	1009	J-12B	154-155	647	116	D-38	T/J-34	S/C-15	T-34	517	3/30/64	6/26/64	12 - 4	18 - 2	79.4	8/5/64	79.4	128	8/13/64	Successful air recovery. Instrument operation good.
84	1603	412	099	9066A	A-22	22	667	71	N/A	N/A	N/A	N/A	526	4/9/64	8/4/64	18 - 0	20 - 3	39.4	8/21/64	39.4	96	8/27/64	Successful air recovery. Instrument operation good. Cloud coverage 60%.
85	1178	405	100	1010	J-11A	152-153	644	113	D-41	T/J-27	S/C-26	T-27	510	3/12/64	7/14/64	17 - 5	26 - 3	80.5	9/14/64	80.5	65	9/18/64	Successful air recovery. Instrument operation good.
	1178	405	100	1010	J-11B	152-153	652	118	D-44	T/J-39	S/C-26	T-44	510	3/12/64	7/14/64	17 - 5	26 - 3	81.5	9/14/64	81.5	144	9/23/64	Successful air recovery. Instrument operation good.
86	1170	421	105	1011	J-03A	160-161	653	119	D-30	T/U-22	S/C-16	T-49	518	5/25/64	8/21/64	12 - 1	18 - 2	78.9	10/5/64	80.0	65	10/9/64	Successful air recovery. Instrument operation good. Drogue chute failed.
	1170	421	105	1011	J-03B	160-161	654	131	D-57	T/J-8	S/C-16	T-20	518	5/25/64	8/21/64	12 - 1	18 - 2	78.7	10/5/64	69.3			Veh battery dropped to 18.5 volts. Attempted recovery on Rev 112. No separation from AGENA.
87	1179	418	107	1012	J-13A	156-157	651	117	D-51	T/U-20	S/C-5	T-43	507	3/30/64	7/30/64	17 - 3	28 - 5	79.7	10/17/64	69.3	49	10/20/64	Successful air recovery. Instr operation good. Beacon problem on AGENA. S/I failure.
	1179	418	107	1012	J-13B	156-157	645	114	D-46	T/J-32	S/C-5	T-32	507	3/30/64	7/30/64	17 - 3	28 - 5	79.7	10/17/64	38.5	81	10/22/64	Guidance problem on AGENA requiring Lifeboat recovery. 48% payload retrieved. Water impact due to weather.
88	1173	420	108	1013	J-15A	158-159	656	127	D-52	T/U-27	S/C-20	T-55	519	4/17/64	9/16/64	21 - 5	28 - 3	79.2	11/2/64	59.4	65	11/6/64	Successful air recovery. Instrs failed on Pass 52. 416 cycles unprogrammed on Rev 1. S/I oper normal.
	1173	420	108	1013	J-15B	158-159	657	133	D-47	T/J-36	S/C-20	T-40	519	4/17/64	9/16/64	21 - 5	28 - 3	79.1	11/2/64	0	81	11/7/64	Successful air recovery. Mission terminated on Pass 52. S/I operation normal.

25X1 25X1

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
89	1180	416	110	1014	J-16A	162	659	128	D-53	T/J-2	S/C-21	T-7	520	6/4/64	10/26/64	20 - 4	23 - 6	79.1	11/18/64	80.0	81	11/23/64	Successful air recovery. Instrument operation normal. No failures in system.
	1180	416	110	1014	J-16B	139	660	132	D-50	T/J-33	S/C-21	T-12	520	8/14/64	11/4/64	11 - 5	13 - 5	79.4	11/18/64	78.0	145	11/27/64	Successful air recovery. Instrument operation normal. No failures in system.
90	1607	424	111	1015	J-17A	138	662	129	D-61	T/J-25	S/C-22	T-33	524	9/30/63	11/16/64	59 - 0	63 - 6	78.9	12/19/64	76.0	81	12/24/64	Successful air recovery. Instrument operation normal after 5 day mission (Drogue chute failed on B).
	1607	424	111	1015	J-17B	141	663	140	D-58	T/J-38	S/C-22	T-38	524	11/15/63	11/16/64	52 - 1	57 - 0	79.0	12/19/64	68.7	175	12/30/64	Successful air recovery. Deactivated for 3 days (1st time). Early recovery due to pyro battery problem on AGENA.
91	1608	414	112	1016	J-18A	132	665	135	D-55	T/U-21	S/C-23	T-47	523	9/6/63	11/24/64	63 - 3	70 - 6	78.7	1/15/65	77.7	81	1/20/65	Successful air recovery aprx 40 miles from estimated point of impact. Instr operation normal.
	1608	414	112	1016	J-18B	133	666	106	D-59	T/J-28	S/C-23	T-28	523	9/6/63	11/24/64	63 - 3	70 - 6	78.5	1/15/65	78.5	159	1/25/65	Successful air recovery. Instrument operation normal. Zero defects on this mission.
92	1611	432	119	1017	J-14A	140	623	109	D-21	T/J-23	S/C-24	T-25	531	11/15/63	12/21/64	57 - 2	66 - 5	79.6	2/25/65	81.2	81	3/2/65	Successful air recovery. Instrument operation good. Zero defects.
	1611	432	119	1017	J-14B	165	625	112	D-60	T/J-25	S/C-24	T-52	531	6/17/64	12/21/64	57 - 2	66 - 5	78.7	2/25/65	75.7	145	3/6/65	Successful air recovery. S/I failure (metering). Yaw programmer failure on Rev 88, capping shutter.
93	1612	429	115	1018	J-19A	122	668	136	D-20	SP-1	S/C-27	T-51	530	5/20/63	1/13/65	35 - 0	45 - 1	79.0	3/25/65	80.5	66	3/29/65	Successful air recovery. Instr operation good. S/I programmer failure, affecting both instrs.
	1612	429	115	1018	J-19B	123	669	108	D-22	T/J-44	S/C-27	T-54C	530	5/20/63	1/13/65	35 - 0	45 - 1	78.7	3/25/65	77.2	99	3/31/65	Successful air recovery. Instrument operation good.
94	1614	437	118	1019	J-04A	118	626	138	D-39	T/U-26	S/C-6	T-53	512	5/8/63	1/28/65	90 - 1	103 - 1	78.1	4/29/65	76.6	80	5/4/65	Successful air recovery. Instrument operation normal.
	1614	437	118	1019	J-04B	119	627	139	D-19	T/J-50	S/C-6	T-60C	512	5/8/63	1/28/65	90 - 1	103 - 1	78.1	4/29/65	79.6	143		No recovery due to malfunction of vehicle. Recovery command system programming.
95	1615	438	121	1021	J-21A	166	674	134	D-63	T/J-45	S/C-32	T-59C	529	11/18/64	4/29/65	23 - 1	25 - 6	77.9	5/18/65	75.4	81	5/23/65	Successful air recovery. S/I failed on 79th rev. Pan instrument operation normal.
	1615	438	121	1021	J-21B	167	670	111	D-25	T/J-48	S/C-32	T-58C	529	11/18/64	4/29/65	23 - 1	25 - 6	78.5	5/18/65	51.9	161	5/28/65	Successful air recovery. Payload in No 1 instr came out of rails because of torn film causing inst failure.
96	1613	444	132	1020	J-20A	136	672	1011	D-67	T/J-13	S/C-28	T-13	501	11/13/64	3/15/65	17 - 3	29 - 5	78.3	6/9/65	77.9	97	6/15/65	Successful air recovery. Instrument operation normal.
	1613	444	132	1020	J-20B	137	673	107	D-62	T/J-40	S/C-28	T-48	501	11/13/64	3/15/65	17 - 3	29 - 5	78.2	6/9/65	28.0	113	6/16/65	Type 9 regulator failed on AGENA causing complete loss of guidance. Recovered by Lifeboat.
97	1617	446	133	1022	J-22A	168	664	119	D-65	T/J-47	S/C-33	T-61C	516	12/28/64	5/17/65	20 - 0	29 - 0	78.9	7/19/65	81.2	65	7/23/65	Successful air recovery. Zero defects for A/P facility.
	1617	446	133	1022	J-22B	169	658	129	D-24	T/J-46	S/C-33	T-56C	516	12/28/64	5/17/65	20 - 0	29 - 0	78.3	7/19/65	76.7	144	7/28/65	Successful air recovery. Cycle counter on No. 2 instrument intermittent.
98	1618	449	134	1023	J-23A	170	621	113	D-17	T/J-43	S/C-31	T-57C	522	1/28/65	6/9/65	18 - 5	28 - 5	78.9	8/17/65	79.9	81	8/22/65	Successful air recovery. Instrument operation normal.
	1618	449	134	1023	J-23B	171	649	114	D-66	T/J-37	S/C-31	T-42	522	1/28/65	6/9/65	18 - 5	28 - 5	78.3	8/17/65	57.7	144	8/26/65	Successful air recovery. Instr No. 1 intermittent. Relay in A/P command box probable cause.
99	1602	401	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9/1/65	N/A	N/A	N/A	Complete RP veh. No A/P range safety. Destructed THOR at T + 57 seconds.
100	1619	458	136	1024	J-24A	172	622	1005	D-69	T/U-19	S/C-34	T-41	515	3/2/65	8/10/65	23 - 0	29 - 1	80.1	9/22/65	81.5	81	9/27/65	Successful air recovery. Low period orbit due to booster. Instrument operation good.
	1619	458	136	1024	J-24B	173	643	118	D-64	T/U-24	S/C-34	T-50	515	3/2/65	8/10/65	23 - 0	29 - 1	80.2	9/22/65	79.8	161	10/2/65	Successful air recovery. Instrument operation good.
101	1616	433	138	1025	JX-28A	142	650	115	D-73	TU-18	S/C-30	T-45	521	12/11/63	9/16/65	92 - 1	94 - 6	78.9	10/5/65	78.8	81	10/10/65	Successful air recovery. Operation normal.
	1616	433	138	1025	JX-28B	127	636	130	D-70	TJ-42	S/C-30	T-36	521	7/26/63	9/16/65	114 - 5	117 - 3	78.9	10/5/65	78.6	161	10/15/65	Successful air recovery. Anomolous deployment of main chute.

TOP SECRET

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
102	1620	439	139	1026	J-25A	174	701	1001	D-75	TJ-78	S/C-35	T-65C	502	4/30/65	10/1/65	22 - 1	26 - 0	78.6	10/28/65	78.6	81	11/2/65	Successful air recovery. Intermittent C F switch operation.
	1620	439	139	1026	J-25B	175	702	1002	D-72	TJ-62	S/C-35	T-62C	502	4/30/65	10/1/65	22 - 1	26 - 0	78.5	10/28/65	77.8	160	11/7/65	Successful air recovery. H O had sticky shutter.
103	1621	448	140	1027	JX-27A	163	648	140	D-71	TJ-19	S/C-29	T-19	532	6/4/64	10/25/65	57 - 6	64 - 5	78.8	12/9/65	55.0	17	12/10/65	Successful air recovery. Instr operation normal. Veh 'D' timer SW failure. Lifeboat recovery.
	1621	448	140	1027	JX-27B	164	655	141	D-68	TJ-41	S/C-29	T-22	532	6/17/64	10/25/65	56 - 0	66 - 4	78.8	12/9/65	0	33	12/11/65	Successful air recovery. No instr operation. Lifeboat recovery.
104	1610	451	141	1028	J-26A	176	703	1003	D-77	TJ-7	S/C-37	T-67C	535	5/26/65	12/2/65	29 - 1	30 - 2	78.6	12/24/65	80.3	81	12/29/65	Successful air recovery. Instr operation perfect. Zero defects.
	1610	451	141	1028	J-26B	177	704	1004	D-74	TJ-64	S/C-37	T-64C	535	5/26/65	12/2/65	29 - 1	30 - 2	79.3	12/24/65	77.6	144	1/2/66	Successful air recovery. Instr 200pps timing intermittent, otherwise zero defects.
105	1623	450	142	1029	J-27A	178	705	1010	D-79	TJ-35	S/C-36	T-69C	540	5/28/65	12/16/65	28 - 6	31 - 2	79.9	2/2/66	79.9	81	2/7/66	Successful air recovery. Zero defects.
	1623	450	142	1029	J-278	179	706	1006	D-76	TJ-66	S/C-36	T-66C	540	5/28/65	12/16/65	28 - 6	31 - 2	79.8	2/2/66	79.8	160	2/12/66	Successful air recovery. S/I non-operational between Revs 81 thru 133.
106	1622	452	143	1030	J-29A	182	709	1009	D-94	TJ-73	S/C-39	T-71C	533	7/2/65	1/24/66	29 - 3	35 - 5	79.1	3/9/66	80.2	81	3/14/66	Successful air recovery. Stepper switch problem. Instrument operation normal.
	1622	452	143	1030	J-298	183	710	1012	D-82	TJ-70	S/C-39	T-68C	533	7/2/65	1/24/66	29 - 3	35 - 5	79.9	3/9/66	78.8	159	3/19/66	Successful air recovery. Same stepper problem. Instrument operation normal.
107	1627	474	146	1031	J-30A	184	711	102	D-83	TJ-81D	S/C-42	T-81D	537	9/21/65	3/2/66	23 - 1	28 - 2	79.7	4/7/66	81.0	113	4/14/66	Successful air recovery first 7 day 'A' mission. Blossom T/M battery failure impact 95 mi long.
	1627	474	146	1031	J-30B	185	712	130	D-86	TJ-65	S/C-42	T-78C	537	9/21/65	3/2/66	23 - 1	28 - 2	79.9	4/7/66	39.8	177	4/18/66	Successful air recovery. Slave camera failed during C&W.
108	1625	465	149	1032	J-28A	180	707	1007	D-81	TJ-67	S/C-38	T-73C	534	7/9/65	4/5/66	38 - 4	42 - 4	80.0	5/3/66	0	0		Failed to achieve orbit.
	1625	465	149	1032	J-28B	181	708	1008	D-80	TJ-5	S/C-38	T-70C	534	7/9/65	4/5/66	38 - 4	42 - 4	79.5	5/3/66	0	0		Failed to achieve orbit.
109	1630	469	150	1033	J-33A	194	717	1017	D-91	TJ-87D	S/C-45	T-87D	543	11/9/65	5/5/66	25 - 2	27 - 6	79.6	5/23/66	82.0	82	5/28/66	Successful air recovery. Instr operation normal.
	1630	469	150	1033	J-33B	195	718	107	D-84	TJ-84	S/C-45	T-84C	543	11/9/65	5/5/66	25 - 2	27 - 6	79.7	5/23/66	77.3	176	6/3/66	Successful air recovery. Instr operation normal.
110	1626	466	153	1034	J-31A	186	713	1013	D-85	TJ-77B	S/C-41	T-77D	538	10/6/65	5/18/66	27 - 4	32 - 3	79.7	6/21/66	79.6	81	6/26/66	Successful air recovery. V/H programmer failure. PMU gas leak out by Rev 30.
	1626	466	153	1034	J-31B	187	714	1014	D-87	TJ-74	S/C-41	T-74C	538	10/6/65	5/18/66	27 - 4	32 - 3	79.7	6/21/66	79.3	161	7/1/66	Successful air recovery. Flashing light failure.
111	1631	506	154	1036	J-32A	190	715	1015	D-89	TJ-83D	S/C-43	T-83D	511	10/27/65	8/1/66	39 - 4	40 - 6	79.5	8/9/66	80.1	115	8/16/66	Successful air recovery. Instrument operation good.
	1631	506	154	1036	J-32B	191	716	1016	D-88	TJ-80	S/C-43	T-80C	511	10/27/65	8/1/66	39 - 4	40 - 6	79.3	8/9/66	78.2	212	8/22/66	Successful air recovery. Instrument operation good.
112	1628	477	164	1035	J-36A	188	723	118	D-95	TJ-75D	S/C-40	T-75D	607	1/26/66	6/21/66	20 - 6	33 - 6	79.8	9/20/66	78.9	81	9/25/66	Successful air catch. Instr operation normal. New OPS selection capability and O S F G.
	1628	477	164	1035	J-36B	189	724	127	D-96	TJ-72	S/C-40	T-72C	607	1/26/66	6/21/66	20 - 6	33 - 6	79.8	9/20/66	80.6	160	9/30/66	Successful air catch. V/H programmer failed on Rev 157.
113	1632	507	178	1037	J-38A	198	727	102	D-101	TJ-101D	S/C-46	T-99E	544	6/30/66	10/13/66	17 - 4	18 - 5	79.7	11/8/66	79.4	66	11/12/66	Successful air recovery, 3rd interim phase III, second PG, & second THORAD launch.
	1632	507	178	1037	J-388	199	728	135	D-106	TJ-89	S/C-46	T-96F	544	6/30/66	10/13/66	17 - 4	18 - 5	78.4	11/8/66	78.2	195	11/20/66	Successful air recovery. Instrument operation normal.
114	1629	495	184	1038	J-34A	192	719	115	D-93	TJ-85D	S/C-44	T-85D	542	12/3/65	1/10/67	57 - 4	58 - 1	81.0	1/14/67	80.3	81	1/19/67	Successful air recovery. Instrument operation normal. High system temp, MIP 80.
	1629	495	184	1038	J-348	193	720	134	D-90	TJ-82	S/C-44	T-82C	542	12/3/65	1/10/67	57 - 4	58 - 1	80.8	1/14/67	81.5	193	1/26/67	Successful air recovery. Instrument operation normal. MIP 80. Temp normal. Ist full + 3 system.

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
115	1635	493	196	1039	J-39A	206	729	1001	D-103	TJ-79D	S/C-51	T-79D	602	4/8/66	2/16/67	44 - 5	44 - 11	80.3	2/22/67	80.76	81	2/27/67	Successful air recovery. Instrument operation normal. High system temp. MIP 85.
	1635	493	196	1039	J-39B	207	730	1010	D-100	TJ-76	S/C-51	T-76C	602	4/8/66	2/16/67	44 - 5	44 - 11	79.9	2/22/67	79.44	177	3/5/67	Successful air recovery. Instrument operation normal. Normal system temp. MIP 85.
116	1636	501	200	1040	J-35A	196	721	136	D-78	TJ-89D	S/C-47	T-89D	539	12/17/65	3/26/67	66 - 2	66 - 6	79.3	3/30/67	76.28	81	4/4/67	SAR S-band link inoperative. B/U employed. MIP 85, temp normal.
	1636	501	200	1040	J-35B	197	722	113	D-92	TJ-86	S/C-47	T-86C	539	12/17/65	3/26/67	66 - 2	66 - 6	79.1	3/30/67	82.12	145	4/8/67	SAR S-band link inoperative. B/U employed. MIP 85. temp normal.
117	1634	508	209	1041	J-40A	208	731	1003	D-105	TJ-99D	S/C-52	T-101E	536	5/20/66	5/4/67	50 - 0	50 - 5	88.5	5/9/67	80.14	93	5/15/67	Successful air recovery.
	1634	508	209	1041	J-40B	209	732	138	D-102	TJ-96	S/C-52	T-98F	536	5/20/66	5/4/67	50 - 0	50 - 5	88.2	5/9/67	78.95	215	5/23/67	SAR pickup 225 nm down range due to abnormal orbit (AGENA velocity meter failure).
118	1633	509	213	1042	J-37A	204	725	129	D-97	TJ-95D	S/C-49	T-95D	528	3/22/65	6/8/67	115 - 3	116 - 4	80.5	6/16/67	78.4	97	6/22/67	Successful air recovery. Instrument operation normal.
	1633	509	213	1042	J-37B	205	726	1005	D-98	TJ-88	S/C-49	T-88C	528	3/22/65	6/8/67	115 - 3	116 - 4	78.1	6/16/67	80.2	143	7/1/67	Water pickup. Instrument operation normal. Chute events late.
119	1637	510	216	1043	J-42A	200	735	127R3	D-107	TJ-91D	S/C-48	T-91D	527	8/4/66	7/27/67	51 - 0	52 - 4	79.9	8/7/67	79.9	113	8/14/67	Successful air recovery. Master scan rate erratic after Rev 68.
	1637	510	216	1043	J-42B	201	736	112	D-112	TJ-92	S/C-48	T-92C	527	8/4/66	7/27/67	51 - 0	52 - 4	80.2	8/7/67	73.2	127	8/22/67	Successful air recovery. Master instrument failed on Rev 228.
120	1641	512	217	1101	CR-1A	302	803	1029	DISIC 3	3	302	T-305	616	2/14/67	9/10/67	29 - 6	30 - 4	79.5	9/15/67	79.5	97	9/21/67	SAR pan & DISIC instrument operation normal. Some early timeouts on exposure control delay.
	1641	512	217	1101	CR-1B	303	804	1028	3	6	302	T-302	616	2/14/67	9/10/67	29 - 6	30 - 4	79.8	9/15/67	79.8	208	9/28/67	Pan & DISIC instrument operation normal.
121	1639	513	221	1044	J-41A	202	733	1004	D-99	TJ-97D	S/C-50	T-97E	606	7/6/66	10/27/67	68 - 1	68 - 6	79.75	11/1/67	79.75	97	11/8/67	SAR instrument operation normal. Impact aprx 60 nm south.
	1639	513	221	1044	J-41B	202	734	130R2	D-104	TJ-94	S/C-50	T-94F	606	7/6/66	10/26/67	68 - 1	68 - 6	78.56	11/1/67	78.56	144	11/11/67	SAR instrument operation normal. Anomaly in Lifeboat timer dictated early recovery.
122	1642	514	223	1102	CR-2A	304	805	1025	DISIC 4	1	303	T-303	626	5/2/67	12/2/67	30 - 5	31 - 5	80.0	12/9/67	80.0	83	12/15/67	SAR, MIP 100. Second J-3 flight.
	1642	514	223	1102	CR-2B	305	806	1026	4	8	303	T-304	626	5/2/67	12/2/67	30 - 5	31 - 5	84.1	12/9/67	84.1	129	12/22/67	SAR, MIP 100. Best of CORONA missions to date.
123	1640	516	226	1045	J-45A	214	741	1022	D-109	TJ-107D	55	T-107E	612	12/9/67	1/19/68	58 - 0	58 - 5	80.5	1/24/68	74.0	112	1/31/68	SAR, MIP 90. 14 day mission despite loss.
	1640	516	226	1045	J-45B	215	742	1023	D-108	TJ-102	55	T-102F	612	12/9/67	1/19/68	58 - 0	58 - 5	80.5	1/24/68	81.5	223	2/7/68	SAR, MIP 90.
124	1638	518	228	1046	J-48A	220	747	1015R2	119	TJ-1130	58	113F	608	6/30/67	3/10/68	35 - 6	36 - 3	81.4	3/14/68	81.4	113	3/21/68	First full load of SO-230. System exhibited a decrease in performance from Rev 9 to end of mission. SAR, MIP 90.
	1638	518	228	1046	J-48B	221	748	1014R2	120	TJ-110	58	110F	608	6/30/67	3/10/68	35 - 6	36 - 3	81.4	3/14/68	81.4	240	3/29/68	SAR, MIP 85.
125	1643	511	233	1103	CR-3A	306	807	1035	DISIC 5	9	304	T-307	621	8/23/67	4/25/68	34 - 4	35 - 3	77.6	5/1/68	77.6	115	5/8/68	Out-of-focus probably caused by film flatness in platen area. Partial load of UTB. SAR, MIP 95.
	1643	511	233	1103	CR-3B	307	808	1036	5	11	304	T-306	621	8/23/67	4/25/68	34 - 4	35 - 3	78.0	5/1/68	78.0	228	5/15/68	SAR, MIP 95.
126	1645	517	235	1047	J-47A	218	745	1017R2	117	TJ-109D	S/C-57	T-109E	604	6/18/67	6/13/68	56 - 12	57 - 2	81.2	6/20/68	81.2	129	6/28/68	Cold booster caused ground track mismatch. AGENA/PL incompatibility caused concern. SAR, MIP 85.
	1645	517	235	1047	J-47B	219	746	1016R2	118	TJ-106	S/C-57	T-106E	604	6/18/67	6/13/68	56 - 12	57 - 2	81.3	6/20/68	81.3	240	7/5/68	SAR, MIP 85.
127	1644	522	238	1104	CR-4A	308	809	1030	DISIC 7	14	305	T-309	618	11/14/67	8/2/68	37 - 0	37 - 5	81.1	8/7/68	81.3	115	8/14/68	PMU failure. T/R failure in "B" bucket. Highest MIP rating for CORONA to date (115).
	1644	522	238	1104	CR-4B	309	810	1031	7	15	305	T-308	618	11/14/67	8/2/68	37 - 0	37 - 5	81.2	8/7/68	81.0	244	8/22/68	SAR, MIP 115.

25X1

25X1

TOP SECRET

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
128	1647	524	240	1048	J-49A	222	749	1010R3	121	TJ-111D	59	T-111E	605	10/23/67	9/13/68	46 - 2	47 - 0	81.4	9/18/68	81.4	145	9/27/68	SAR, MIP 85. P/L tear in "B" mission and instrument failure.
	1647	524	240	1048	J-49B	223	750	135R3	116	TJ-108	59	T-108F	605	10/23/67	9/13/68	46 - 2	47 - 0	81.1	9/18/68	56.6	224	10/2/68	SAR, MIP 85. Instrument failure.
129	1646	515	242	1105	CR-5A	310	811	1032	NONE	NONE	301	T-311	601	2/2/68	10/24/68	37 - 5	39 - 1	79.4	11/3/68	79.4	131	11/11/68	SAR, MIP 100. Both instruments failed at end of mission.
	1646	515	242	1105	CR5B	311	812	1033	NONE	NONE	301	T-312	601	2/2/68	10/24/68	37 - 5	39 - 1	76.9	11/3/68	76.9	292	11/21/68	SAR, MIP 100.
130	1648	527	243	1049	J-50A	224	751	134R3	D-123	TJ-115E	60	T-115E	609	1/22/68	12/5/68	45 - 0	46 - 0	80.6	12/12/68	80.6	99	12/18/68	SAR, MIP 85. Out-of-focus, only fair quality. Heavy rail scratching.
	1648	527	243	1049	J-508	225	752	115R3	D-124	TJ-112F	60	T-112F	609	1/22/68	12/5/68	45 - 0	46 - 0	79.9	12/12/68	79.9	179	12/18/68	SAR, MIP 85.
131	1650	519	244	1106	CR-6A	312	801R	1027	DISIC 6	18	307	T-313	627	3/26/68	1/30/69	44 - 2	45 - 1	81.5	2/5/69	81.2	66	2/9/69	SAR, MIP 105. First DSR command system flown. Degraded by haze.
	1650	519	244	1106	CR-6B	313	802R	1024	6	22	307	T-314	627	3/26/68	1/30/69	44 - 2	45 - 1	80.2	2/5/69	74.0	147	2/14/69	SAR, MIP 105. All quality good to fair.
132	1651	541	245	1050	J-43A	210	737	1023	109	TJ-93D	53	T-93D	611	10/17/68	3/14/69	125 - 1	125 - 6	81.3	3/19/69	46.2	34	3/21/69	SAR, MIP 85. Problems on vehicle guidance requiring early recovery on both "A" and "B." Both instruments out-of-focus cond.
	1651	541	245	1050	J-43B	211	738	137	110	TJ-9D	53	T-90C	611	10/17/68	3/14/69	125 - 1	125 - 6	81.0	3/19/69	80.6	50	3/22/69	SAR, MIP 85.
133	1649	544	246	1051	J-44A	212	739	1020	115	TJ-105D	54	T-105E	617	11/17/68	3/24/69	126 - 4	127 - 4	80.5	5/1/69	80.1	113	5/8/69	SAR, MIP 80.
	1649	544	246	1051	J-44B	213	740	1012	116	TJ-100	54	T-100F	617	11/17/68	3/24/69	126 - 4	127 - 4	80.5	5/1/69	80.1	256	5/17/69	SAR, MIP 80. "B" recovery was the 50th consecutive recovery.
134	1652	038	247	1107	CR-7A	314	813	1034	DISIC 11	12	306	T-317	630	4/20/68	7/17/69	64 - 5	65 - 4	80.7	7/23/69	50.7	147	8/1/69	MIP 95. Water pickup. 2nd flight utilizing DSR cmnd system.
	1652	038	247	1107	CR-7B	315	814	1041	11	17	306	T-310	630	4/20/68	7/17/69	64 - 5	65 - 4	81.5	7/23/69	48.0	308	8/11/69	SAR, MIP 95. No. 2 instr failed on 1st day. DISIC failed on 18th day.
135	1653	300	248	1052	J-46A	216	743R	118R2	D111	T-93D	56	T-93D	614	2/10/67	9/11/69	134 - 6	136 - 2	79.1	9/22/69	79.1	115	9/29/69	SAR, MIP 85.
	1653	300	248	1052	J-46B	217	744R	1013R1	D110	T-90C	56	T-90C	614	2/10/67	9/11/69	134 - 6	136 - 2	80.2	9/22/69	80.2	244	10/7/69	SAR, MIP 85. Last of the J-1 series payloads.
136	1655	039	249	1108	CR-9A	316	817	1037	12	10	314	T-331	633	10/16/68	11/21/69	57 - 2	59 - 3	80.6	12/4/69	80.6	115	12/10/69	SAR, MIP 105. These MIPs are the highest achieved by a CORONA system for a launch near the winter solstice.
	1655	039	249	1108	CR-9B	317	818	1039	12	13	314	T-330	633	10/16/68	11/21/69	57 - 2	59 - 3	81.5	12/4/69	81.5	276	12/21/69	SAR, MIP 100.
137	1657	041	251	1109	CR-10A	320	819	1040	9	23	308	T-319	628	5/15/69	2/26/70	40 - 6	41 - 5	81.2	3/4/70	81.2	115	3/11/70	SAR, MIP 110.
	1657	041	251	1109	CR-10B	321	820	1044	9	28	308	T-318	628	5/15/69	2/26/70	40 - 6	41 - 5	78.6	3/4/70	78.6	309	3/23/70	SAR, MIP 100.
138	1656	045	252	1110	CR-11A	322	821	1042	10	25	309	T-325	624	6/16/69	5/14/70	47 - 5	48 - 4	80.0	5/20/70	80.0	179	6/31/70	SAR, MIP 90.
	1656	045	252	1110	CR-11B	323	822	1043	10	26	309	T-324	624	6/16/69	5/14/70	47 - 5	48 - 4	80.1	5/20/70	80.1	308	6/6/70	SAR, MIP 95.
139	1654	556	253	1111	CR-12A	324	823	1025	02R	16	310	T-323	625	9/25/69	7/15/70	41 - 5	42 - 5	80.3	7/22/70	80.3	112	7/29/70	SAR, MIP 105. Imagery produced by the aft-looking instrument is considered the best in CORONA program for 2nd generation lens.
	1654	556	253	1111	CR-128	325	824	1026	02R	20	310	T-316	625	9/25/69	7/15/70	41 - 5	42 - 5	77.5	7/22/70	77.5	301	8/10/70	SAR, MIP 105.
140	1658	552	254	1112	QR-2A	300	827	1038	08	4R	299	T-333	613	1/4/70	11/11/70	200 - 3	201 - 3	80.6	11/18/70	78.1	147	1/27/70	SAR, MIP 115. DISIC failed 5 hours after C/S. #2 main failed at C/W.
	1658	552	254	1112	QR-2B	301	828	1039	08	21	299	T-322	613	1/4/70	11/11/70	200 - 3	201 - 3	80.3	11/18/70	40.3	309	12/7/70	SAR, MIP 115.

TOP SECRET

TABLE 9-1 (CONT'D)

PROG FLT NO.	VEH NO.	THOR NO.	DD 250 NO.	MSN NO.	INSTR TYPE	INSTR NO.	SRV NO.	TM NO.	SI NO.	SI TU CASS'T	SUPPLY CASS'T	MAIN TU CASS'T	DRCG NO.	INSTR REC'D AT AP	SHIP TO BASE	WKS-DYS AT AP	TOTAL WEEKS UNTIL FLIGHT	POUNDS PAYLOAD WEIGHT FLOWN	FLIGHT DATE	POUNDS PAYLOAD WEIGHT TRANS	NO. OF ORBITS	RECOVERY DATE	REMARKS
141	1659	537	255	1113	CR-13A	326	825	1031R2	13	19	312	T-327	620	10/11/69	2/10/71	69 - 3	70 - 3	80.8	2/17/71	0	0		THOR booster failure. Destruct 35 seconds after launch.
	1659	537	255	1113	CR-13B	327	826	1032	13	29	312	T-326	620	10/11/69	2/10/71	69 - 3	70 - 3	80.0	2/17/71	0	0		
142	1660	538	256	1114	CR-14A	328	829	1029R	1R	24	315	T-321	629	2/6/70	3/17/71	57 - 5	58 - 5	80.5	3/24/71	80.0	115	3/31/71	SAR, MIP 120. This system exhibited the highest MIP rating in the CORONA program.
	1660	538	256	1114	CR-14B	329	830	1037	1R	2R	315	T-328	629	2/6/70	3/17/71	57 - 5	58 - 5	78.5	3/24/71	73.0	260	4/9/71	SAR, MIP 125.
143	1662	567	257	1115	CR-15A	330	831	1041	14	7	313	T-329	623	8/19/70	9/5/71	76 - 3	77 - 1	79.0	9/10/71	79.0	115	9/17/71	SAR, MIP 120.
	1662	567	257	1115	CR-158	331	832	1040	14	27	313	T-320	623	8/19/70	9/5/71	76 - 3	77 - 1	78.5	9/10/71	78.5	309	9/29/71	SAR, MIP 110.
144	1661	569	258	1116	CR-16A	332	833	1045	N/A	N/A	316	T-315	619	8/5/70	4/14/72	80 - 6	80 - 11	80.8	4/19/72	80.8	180	4/30/72	SAR, MIP 115.
	1661	569	258	1116	CR-16B	333	834	1044	N/A	N/A	316	T-300	619	8/5/70	4/14/72	80 - 6	80 - 11	80.8	4/19/72	80.8	309	5/8/72	SAR, MIP 115.
145	1663	571	259	1117	CR-8A	318	815R	1038	N/A	N/A	311	T-301	615	8/27/68	5/16/72	184 - 11	184 - 20	80.0	5/25/72	80.0	34	5/27/72	SAR, MIP 115. Solar array failed to deploy. Also leak in control gas system on vehicle reduced mission life to 6 days.
	1663	571	259	1117	CR-8B	319	816R	1046	N/A	N/A	311	T-332	615	8/27/68	5/16/72	184 - 11	184 - 20	80.1	5/25/72	80.1	98	5/31/72	SAR, MIP 115.

TOP SECRET

25X1

25X1

DEPARTMENT OF STATE

Washington, D.C. 20520

NSC UNDER SECRETARIES COMMITTEE

TOP SECRET
NSC-U/SM-157A

September 29, 1976

TO: The Deputy Secretary of Defense
The Assistant to the President for National Security Affairs
The Director of Central Intelligence
The Chairman of the Joint Chiefs of Staff
The Director, Office of Management and Budget
The Under Secretary of Commerce
The Director, Office of Science and Technology Policy
The National Reconnaissance Officer
The Administrator, National Aeronautics and Space Administration

SUBJECT: Policy on Remote Earth Imagery

Attached for your comment and/or concurrence are a draft Memorandum for the President and a report prepared by the Standing Committee on Space Policy. Clearances and minor editorial comments may be provided to Mr. Michael Michaud, Department of State, 632-8018; substantive comments should be addressed to the Chairman of the Under Secretaries Committee in writing. Your response is requested by c.o.b. Tuesday, October 12, 1976.

Rutherford M. Poats
Acting Staff Director

Attachments:

As stated

cc: AID
ACDA
USGS

TOP SECRET

[redacted]

25X1

25X1

CY 9

NSC UNDER SECRETARIES COMMITTEE

TOP SECRET

25X1 [redacted]

MEMORANDUM FOR THE PRESIDENT

Subject: Policy on Remote Earth Imagery

The Standing Committee on Space Policy of the Under Secretaries Committee, which was established by your direction in 1975, has undertaken as its first task a review of policy on remote earth imagery.

I am transmitting herewith a report on remote earth imagery policy, prepared by the Standing Committee. This report represents the first interagency review of USG policy governing remote earth imagery since 1966. The Standing Committee has identified one issue as central to updating our policy and provides a detailed analysis and options for your consideration. Certain other issues on which there is a consensus are presented in the form of recommendations.

US Remote Earth Imagery Programs

The US currently operates two wholly separate satellite programs which acquire images of the earth. On the one hand, intelligence programs are classified and compartmented, and are used principally (although not solely) to acquire foreign military information that is essential to US defense planning

TOP SECRET

25X1 [redacted]

and arms control verification. Intelligence programs stress high spatial resolution. On the other hand, civil imagery programs have been open, unclassified and used to acquire global information on a routine, repetitive basis. Civil programs have tended to utilize a variety of sensors, rely heavily on digital processing techniques for data extraction and stress precise spectral resolution (which permits fine discrimination between wave lengths of recorded energy) rather than high spatial resolution.

To date most of the federal civil users who have access to high resolution imagery have found it useful. High resolution imagery (for the purpose of this study defined as resolution better than 20 meters) is produced only by the intelligence program at present, and is not contemplated in the US open civil programs until the shuttle is flying in the 1980's.

Objectives

The Standing Committee has postulated the following objectives for US remote earth imaging programs:

-- to continue to protect the US intelligence program from direct challenge, external regulation, or interference;

-- to avoid compromising technology which reveals the precise characteristics of US equipment used

25X1

in the intelligence program or which reveals US intelligence capabilities and methods;

-- to avoid providing outside of protected channels imagery which compromises classified information on US military operations or defense installations;

-- to promote complete freedom in the acquisition of imagery in both civil and intelligence programs, and in the distribution of unclassified imagery and data in any eventual international legal regime for remote earth imagery;

-- to maintain the civil character and control of the US civil program for remote earth imagery while taking pertinent security considerations into account, including provisions for dedication of such programs to national security purposes when directed by the President in time of national emergency;

-- to continue to use cooperation with other countries in remote earth imagery and other space applications as an important element in our foreign relations, with particular emphasis on sharing the products of such technology to assist developing countries;

-- to provide federal civil users the best imagery available at the lowest classification possible

within national security constraints in order that the requirements of federal civil users can be met to the extent feasible and that the maximum utility may be extracted from satellite photography produced by the intelligence program;

-- to make publicly available the most useful unclassified imagery and unclassified data derived from classified imagery both of the US and of the world for scientific research, economic development, commercial applications, and other appropriate purposes.

Classification

The present US policy is to refuse to confirm in any unclassified official statement the fact that the US conducts photo-reconnaissance from satellites, and the "fact of" the intelligence program is classified SECRET. In effect this policy also precludes the release outside classified channels of any imagery or derived information with attribution to a classified imagery satellite source. Thus the use of intelligence imagery for civil purposes is severely constrained. On the one hand, it is argued that the uncertain risks to the intelligence program associated with official acknowledgment at this time outweigh the potential benefits of opening the way for greater civil use of intelligence data. On the other hand, it is argued that the intelligence program is such an

25X1

open secret that there is little risk in making intelligence imagery which reveals no classified information available for broader civil use.

Members of the Under Secretaries Committee who favor maintaining classification of "fact of" include State, DOD, NASA, JCS, CIA, and NRO. ACDA shares this view. Members who favor declassifying "fact of" without revealing classified information on the program itself include Commerce and OMB. Interior and AID share this view.

OMB, in commenting on the attached report, has expressed the judgment that the report gives insufficient emphasis to the programmatic and budgetary implications of a decision not to seek declassification of "fact of". Other agencies believe that they have given appropriate consideration to programmatic and budgetary alternatives in arriving at their positions.

Recommendations

The Under Secretaries Committee reached consensus on the following recommendations and recommends that you approve them:

1. That there be limited expansion of federal civil use of high-resolution imagery acquired by the intelligence programs.

2. That civil programs be permitted to utilize acquisition resolution of no better than 10 meters on an open worldwide basis with better resolution being considered on a case-by-case basis.

3. That the USG continue its efforts to ensure that any international legal regime governing remote sensing activities does not restrict our freedom to acquire and disseminate remote earth imagery.

4. That the President reaffirm, as classified internal USG policy, that programs devoted to military or intelligence purposes will not be constrained by any international regime governing civil remote sensing activities.

5. That NRO and NASA should continue their efforts to utilize common techniques and services when appropriate and otherwise continue to coordinate their programs through the recently established Program Review Board. Periodically the Program Review Board should report to the Standing Committee on the results of these coordination actions.

6. That the objectives postulated for US remote earth imaging programs be endorsed, and, together with the above options and recommendations that are approved, be incorporated

25X1

into new policy guidelines governing the civil and intelligence remote sensing programs and the relationship between the two.

Charles W. Robinson
Chairman

Attachment:

Report - Remote Earth Imagery Policy

Drafted: PM/ISP:ARTurrentine/MAGMichaud:jan
9/27/76 x 28018

Approved For Release 2005/06/09 : CIA-RDP89B00980R000500070001-2

25X1 [redacted]

NSC Under Secretaries Committee
Standing Committee on Space Policy
Report

Subject: Remote Earth Imagery: Policy Issues, Options, and Recommendations

The Problem: Present USG policy governing remote earth imagery is based on guidance issued in 1960 and revised most recently in 1966. Is this policy still valid, or are certain changes permissible and desirable in the current international environment? The Standing Committee on Space Policy has addressed this question in a review of remote sensing issues in general, and the relationship between the civil and intelligence programs in particular. An analysis of the issues together with policy options and recommendations are contained in the following report.

Conclusions: After reviewing the problem, the Standing Committee finds little to be gained from merging or radically restructuring the relationship between the civil and intelligence imagery programs at this time. However, it was agreed that there is merit in updating our remote earth imagery guidelines with a view toward facilitating the use of classified imagery from space for appropriate civil purposes. This report explains how these conclusions were reached and offers specific recommendations for implementing them.

Background: The legitimacy of one nation photographing the territory of another from space had not been established when US policy on remote earth imagery was first formulated in 1960. In the wake of the U-2 incident (1960), there was considerable uncertainty as to how the Soviet Union might respond to our satellite reconnaissance program. We sought to avoid posing a direct political challenge to the Soviet Union on this issue by carrying out our intelligence program in total secrecy,

[redacted] 25X1

even to the point of prohibiting officials from acknowledging its existence in public. At the same time we sought to gain broad international acceptance of remote earth sensing as a legitimate activity through open civil programs. We have avoided, however, acquiring and releasing unclassified imagery that might be unduly provocative and we have not incorporated technology in civil systems that would disclose the technical capabilities of US intelligence systems. The spatial resolution permitted in the civil program has been limited to no better than 20 meters photographic ground resolution from earth orbit, in part to avoid arousing international political sensitivities.

Thus, the USG currently operates two wholly separate satellite programs which acquire images of the earth. On the one hand, intelligence programs are classified and compartmented, and are used principally (although not solely) to acquire foreign military information that is essential to US defense planning and arms control verification. Intelligence programs stress high spatial resolution (which reveals minute details), are directed against specific targets, and have relied heavily on film return systems and on photo-interpretation techniques for data extraction. [redacted]

25X1
NSC

On the other hand, civil imagery programs have been open, unclassified and used to acquire global information on a routine, repetitive basis about such things as the earth's resources and natural phenomena for use by a wide variety of consumers, including government agencies, commercial interests, and scientists in the US and abroad. Civil programs have tended to utilize a variety of sensors, rely heavily on digital processing techniques for data extraction and stress precise spectral resolution (which permits fine discrimination between wave lengths of recorded energy) rather than high spatial resolution.

In sum, the civil and intelligence remote earth imagery programs have been developed separately in response to different requirements and as a matter of policy. They are under separate management, stress different

technical approaches, have entirely different program objectives and different data distribution policies. For the past decade the US civil programs have been coordinated closely with the military and intelligence communities to mitigate any actual or potential impact on the interests of the intelligence program. At the same time, the US civil programs have been coordinated closely with the foreign affairs agencies to serve US foreign policy interests, promote international acceptance of remote earth sensing for peaceful purposes, and avoid generating undue international concerns. In general, this dual approach - separate but closely coordinated - has served US policy interests well over the years.

The New Environment: Since the last major review of remote earth imagery policy in 1966, there have been a number of pertinent developments including the following:

-- broad international awareness and tacit acceptance of intelligence satellites in general, and implicit acceptance by the Soviet Union of intelligence reconnaissance satellites under the euphemism "national technical means of verification" as used in the US-Soviet SALT arrangements;

-- the steady growth and general international acceptance of the operational US environmental satellite programs (ITOS, DMSP, TIROS-N) which routinely acquire global data openly available to the public;

-- the initiation and continuation of the experimental civil US earth resources satellite program (Landsat) routinely acquiring global data which is openly available to the public;

-- growing utilization of data from the US civil programs by domestic and foreign users who are increasing their investment in training, ground stations, etc., and thus have a concomitant interest in assured program continuity and improved data;

25X1

-- the development by the US of the Space Shuttle and by the Europeans of its companion, the Spacelab, which in the near future may provide repetitive access to space by any participant for any peaceful purpose, including remote sensing;

-- utilization by some civil USG agencies of selected high resolution intelligence satellite imagery on a classified basis;

-- 68 countries, including the US and the Soviet Union, have ratified or acceded to the Outer Space Treaty of 1967, which states in Article I that "...outer space...shall be free for exploration and use by all States without discrimination of any kind...in accordance with international law...";

-- continuing interest in remote sensing issues at the United Nations directed toward the development of an international legal regime governing remote sensing activities. (At present some countries are calling for controls on the dissemination of data pertaining to natural resources);

-- recent indications of interest by the Soviet Union in establishing a resolution limit by international agreement beyond which data would not be disseminated to third countries without the consent of the sensed state. (This proposal applies only to dissemination and not to acquisition.);

-- indications that commercial interests may wish to invest in a private earth sensing program (a consortium of oil companies has been mentioned as well as a venture along the lines of COMSAT/INTELSAT);

-- resumed testing by the Soviet Union of antisatellite systems;

-- growing US dependence on intelligence collection from space, including imaging satellites, in support of national security and defense, as other sources decline in productivity for a variety of reasons;

-- improvements in resolution of intelligence satellites with corresponding increase in the potential psychological, hence political, impact should our best capability be disclosed.

US Objectives: In considering this new environment we have postulated the following policy objectives for US remote earth imaging programs:

-- to continue to protect the US intelligence program from direct challenge, external regulation, or interference;

-- to avoid compromising technology which reveals the precise characteristics of US equipment used in the intelligence program or which reveals US intelligence capabilities and methods;

-- to avoid providing outside of protected channels imagery which compromises classified information on US military operations or defense installations;

-- to promote complete freedom in the acquisition of imagery in both civil and intelligence programs, and in the distribution of unclassified imagery and data in any eventual international legal regime for remote earth imagery;

-- to maintain the civil character and control of the US civil program for remote earth imagery while taking pertinent security considerations into account, including provisions for dedication of such programs to national security purposes when directed by the President in time of national emergency;

-- to continue to use cooperation with other countries in remote earth imagery and other space applications as an important element in our foreign relations, with particular emphasis on sharing the products of such technology to assist developing countries;

-- to provide federal civil users the best imagery available at the lowest classification possible within national security constraints in order that the requirements of federal civil users can be met to the extent feasible and that the maximum utility may be extracted from satellite photography produced by the intelligence program;

-- to make publicly available the most useful unclassified imagery and unclassified data derived from classified imagery both of the US and of the world for scientific research, economic development, commercial applications, and other appropriate purposes.

Issues and Options: The Standing Committee has identified one issue as central to updating our remote earth imagery policy. This issue is discussed and analyzed in terms of pros and cons. Policy options are offered for the President's consideration.

Issue #1 - Should the existence of the US intelligence remote earth imaging program be declassified in order to permit greater civil use of data which would otherwise qualify as unclassified?

Discussion: The present US policy is to refuse to confirm in any unclassified official statement the fact that the US conducts photo-reconnaissance from satellites, and the "fact of" the intelligence program is classified SECRET. In effect this policy also precludes the release outside classified channels of any imagery or derived information with attribution to a classified imagery satellite source. We have refused confirmation of the intelligence reconnaissance satellites in order to avoid putting other

nations in a position where they might feel compelled to protest formally such intelligence sensing of their countries. Even though the intelligence program has been discussed in the press and is implicitly acknowledged in the SALT arrangements under the euphemism "national technical means of verification", it is argued that lack of official confirmation has permitted other governments to ignore the issue. It should be noted that, on occasion and very early in the intelligence program, the "fact of" reconnaissance satellite programs was acknowledged. On one occasion over ten years ago the President mentioned the value of the intelligence reconnaissance program in an off-the-record public statement which was nevertheless reported in the press. Also, various senior government officials have used information in public hearings before the Congress which clearly could have only come from very high resolution satellite or aircraft imagery.

There is a growing sentiment in some quarters of the USG for declassifying the "fact of" the US intelligence reconnaissance satellite program in a low-key, carefully controlled manner without discussing or disclosing details. It is argued that this would put the USG in a more credible position with Congress and the public, and would also permit wider civil use of sanitized imagery or unclassified derived information from the intelligence program. At present we are caught in a "Catch 22" situation of being inhibited in the use of imagery from the intelligence program if such use might be attributed to or confirm the existence of the intelligence imagery satellite system. Declassification of the "fact of" the intelligence program would not of itself result in the declassification of any intelligence system or product. Thus it need not affect the continued classification of sensitive technical details nor lead inevitably to dissemination of imagery in forms which would reveal our most sensitive capabilities. It would permit the availability and level of classification of intelligence product for civil use to be based on a case-by-case determination of the degree of risk to national security associated with the particular product. For example, information derived from intelligence imagery, but other-

25X1

wise unclassified, could be presented "legally" to the public and the Congress when this was deemed to be in the national interest. Declassifying "fact of" would also make it possible to use derivative information that was otherwise unclassified in support of foreign aid programs and disaster relief, since in both cases there is a need for information that can be obtained only from high resolution imagery which the current civil space program is unable to provide.

Issue #1 - Declassification of "fact of"

pros:

-- would facilitate wider use of intelligence satellite imagery and derived information in support of US political and military policy;

-- would permit wider use of high resolution intelligence imagery and unclassified derived information among federal civil agencies and possibly other civil users;

-- the fact that the US has an intelligence photographic satellite program is widely known and probably cannot be considered to be a "SECRET" in the meaning of Executive Order 11652;

-- would permit the USG to take a more credible position on this issue;

-- could facilitate excluding national security systems explicitly from any definition in the UN of remote sensing that might be used in a future international legal regime;

-- declassification of "fact of" could facilitate employment of high-resolution imagery technology in support of foreign aid and disaster relief programs.

Issue #1 - Declassification of "fact of"

cons:

-- courts risk of unfavorable international political reaction, particularly when the

25X1

change in US policy is detected by the press (some members of the press, particularly those who follow technical issues, are aware of the US policy regarding "fact of" in spite of the fact that it is classified);

-- might lead to relaxation within the USG in the attitude of those who have knowledge of the intelligence program and lead to increased leaks or disclosure of genuinely sensitive information;

-- once we acknowledge officially the existence of the US intelligence satellite program we cannot reverse our position if reactions are adverse;

-- acknowledgment could stimulate greater interest in the program with demands for sensitive classified details by the public, the media, and the Congress;

-- public acknowledgment of the US intelligence imagery satellite program may excite debate which could lead some nations to press for a restrictive international legal regime governing remote sensing. It could also lead to explicit inclusion of intelligence programs in such a restrictive legal regime, which the US would be unable to accept.

Agency Views - Although there were dissenting views, the majority of the Standing Committee members believe that the uncertain risks to the intelligence program associated with official acknowledgment at this time outweigh the potential benefits of opening the way for greater civil use of intelligence data. Members who favor maintaining classification of "fact of" include NASA, JCS, CIA, NRO, State, and DOD. ACDA shares this view. Members who favor declassifying "fact of" without revealing classified information on the program itself include NOAA and OMB. Interior and AID share this view.

Issue #1 Option A - Maintain classification of "fact of" US satellite reconnaissance intelligence program.

ALTERNATIVELY

Option B - Permit declassification of the existence of the US satellite reconnaissance program in a controlled, low-key manner, without revealing classified details about the program itself.

Recommendations: During the course of its review, the Standing Committee reached a consensus on certain other issues which follow in the form of recommendations.

Recommendation # 1 - That there be limited expansion of federal civil use of high-resolution imagery acquired by the intelligence program.

Discussion: There are essentially two categories of domestic civil users, whose requirements are quite different: a) selected personnel in a few US civil government agencies who have security clearances for access to imagery of the US acquired from intelligence programs; and b) other federal and non-federal US users who do not have access to intelligence data and most of whom will not have access to any classified information.

To date most of the federal civil users who have access to high resolution imagery have found it useful. (For the purposes of this study high resolution is defined as resolution better than 20 meters.) High resolution imagery is produced only by the intelligence program at present, and not contemplated in the US open civil programs until the Shuttle is flying in the 1980's. If a decision is made to declassify some of the intelligence product (which would necessitate declassifying "fact of" as dis-

cussed in Issue #1 above) both categories of users might benefit from access to additional high resolution imagery. However, there are limits on the amount of high resolution data the federal civil users can handle and the costs they could bear to acquire such imagery.

The Director of Central Intelligence is currently exploring the possibilities for sanitization of selected high resolution imagery of the US from the intelligence program and, if found to be feasible, will promulgate guidelines and procedures for such sanitization. It is anticipated that such sanitization would obscure the satellite source and not compromise high resolution intelligence capabilities.

Regardless of whether or not the "fact of" the existence of the intelligence program is declassified, there is a need for better mechanisms for coordination and consideration of all civil requirements. At the present time, the Committee for Civil Applications of Classified Overhead Photography of the US, an interagency committee chaired by the Department of Interior, establishes consolidated requirements only for selected federal civil agencies for high resolution imagery of the US. The intelligence programs are requested to meet these imagery requirements to the extent possible. This committee does not consider the requirements of non-federal users. While the federal civil users can request decompartmentation of intelligence data to facilitate its use, existing procedures are cumbersome and the amount of data acquired by the intelligence programs in response to the requirements of federal civil users is limited owing to higher priority needs for foreign intelligence collection. One way in which federal civil user needs might be better taken into account would be to expand the membership and mandate of the Committee for Civil Applications of Classified Overhead Photography of the US.

Expanded use of data from the intelligence program would make it feasible to satisfy most important requirements of federal civil users for high resolution domestic imagery with existing systems. It would allow more federal

25X1

civil users to gain experience in using high resolution imagery and determine its value relative to other products. It also would permit intelligence satellite imagery acquired at considerable cost to be used more readily as a national resource while taking security factors into account.

On the other hand, the idea of "expanding the role" of the intelligence community into the civil sector might be politically unacceptable to a significant part of US society, although the Committee for Civil Applications decouples direct involvement of the foreign intelligence program in domestic affairs. Also, security control over classified intelligence imagery might be degraded by expanded federal civil use. Some countries might be stimulated to call for international restrictions on intelligence satellite systems if it were suspected that the US intelligence program is being used to provide data on their national resources (even if in fact such data were limited to the US, restricted to the US federal civil agencies, and remained classified). [redacted] There also are legal problems of using data for certain federal civil purposes, such as law enforcement, if such data is produced by programs funded through defense or intelligence budgets, and there is a risk of compromising classified information if data from intelligence programs becomes involved in civil litigation. The members of the Standing Committee have weighed these arguments and have concluded that there should be a limited expansion of federal civil use of high resolution imagery acquired by the intelligence program.

25X1 NSC

The Space Policy Committee intends to examine options under this recommendation. One would be to extend the charter of the Interior chaired Commission to cover domestic requirements for high resolution imagery of all federal civil users. Another would be to explore the possibility of expanding the [redacted] making a portion of the capability available for domestic requirements of federal civil users.

25X1 NRO NSC

25X1 [redacted]

Recommendation # 2 - That civil programs be permitted to utilize acquisition resolution of no better than 10 meters on an open worldwide basis with better resolution being considered on a case-by-case basis.

Discussion: In 1966 a ground resolution criterion of "no better than 20 meters" was set as the assumed level of international acceptance which would also not compromise US technology and reveal US capabilities. Civil space programs did not approach this level of quality until 1973, when Skylab imagery of 10 meter resolution was authorized as an exception (in part as a test of international reactions, in part as a test of the civil utility of this higher resolution imagery). All Skylab imagery, including imagery with 10 meter resolution, was released for public use, after a careful security screening of photography that was considered potentially sensitive, and no negative international reactions have been recorded. On the contrary, domestic and foreign users have indicated much interest in using imagery of this quality or better were it routinely and repetitively acquired. Landsat, by contrast, is currently providing useful repetitive multispectral coverage of the world's land masses but at a ground resolution of some 200 meters. Landsat-C will be providing some data at 100 meters resolution by 1977; the next generation of automated satellites in the early 1980's will be operating at about 75 meters resolution. The advent of the Space Shuttle, however, brings the use of high quality film cameras for earth observation within the reach of many nations. The European Space Agency, for example, is planning to use a 60-cm focal length camera on the first Spacelab mission which will be launched by Space Shuttle around 1980 to return selected, non-repetitive worldwide imagery in the 10 meter resolution class. Widespread international recognition of the utility of remote sensing over the past decade has apparently been successfully fostered by the US in accord with the 1966 policy guidelines. In terms of ground resolution without regard to imagery content it appears that the threshold of political sensitivity has dropped at least to the 10 meter range and on a selective basis could be tested at an even lower level.

It should be recognized, however, that defense concerns with regard to satellite imagery are not limited to the revelation of high resolution capabilities. There may be considerable intelligence of military significance extracted from imagery having a resolution in the 75 meter range, particularly if coverage is repetitive and frequent. Such programs will be capable of acquiring classified information on US defense forces and facilities that might be of value to other nations. The Soviet Union and others are likely also to be sensitive to the open availability of such imagery. This concern will pertain as well to commercial and foreign civil satellite systems (e.g. European) for which the US may be asked to provide launch services. This paper does not address these issues since the capabilities are still some years in the future, but the problem needs to be kept under review by the Standing Committee.

Recommendation #3 - That we continue our efforts to ensure that any international legal regime governing remote sensing activities does not restrict our freedom to acquire and disseminate remote earth imagery.

Discussion: The threat of international restrictions on remote sensing from space is ambiguous. On the one hand, there has been growing support for the experimental Landsat program from a considerable number of foreign nations, many of which are building an interest in this and future programs as they invest in ground stations and technical training, and establish programs dependent on a continued flow of data and imagery. A number of countries have now signed bilateral agreements with the US that require open distribution of Landsat data. On the other hand, a number of countries -- including some of those who have committed themselves in bilateral agreements to open distribution of Landsat data -- have espoused positions that would restrict in future operational systems the sensing and distribution of space acquired imagery concerning natural resources without the approval of the sensed country. Clearly the threat of restriction has not disappeared.

In general, the US would like to postpone adoption of principles by the UN until adequate experience has been gained with experimental systems such as Landsat. The more experience each country gains with an open remote sensing program with unrestricted distribution, the less severe pressures for future constraints and procedures are likely to be on an operational system. Practicably we would like to see the development of principles on remote sensing which are permissive enough to be acceptable to both civil and intelligence programs.

It is not clear, however, how long it will be possible for the US to forestall UN resolutions that call for restriction of remote earth sensing and particularly distribution of imagery data acquired from space. Thus, the Standing Committee should keep this problem under close review.

Recommendation #4 - That the President reaffirm, as internal USG policy, that programs devoted to military or intelligence purposes will not be constrained by any international regime governing civil remote sensing activities. (It is not envisaged that such a statement would be made public at this time.)

Discussion: As we work in the UN toward the eventual establishment of agreed principles governing the acquisition, distribution, or utilization of civil remote earth imagery, we should continue to resist any restrictions on our freedom to acquire and disseminate data. However, should our best efforts fail to prevent the development of an international consensus that some controls or restrictions should be adopted, even if only on a voluntary basis, then we should ensure that our programs devoted to national security purposes are excluded from any such provisions. It should be noted that this objective could be achieved by explicitly defining civil programs, or including a "military" exclusion clause. We would be confirming, at least tacitly, the existence of the intelligence program and acknowledging the "fact of" by attempting to negotiate a "military" ex-

clusion clause which could reopen the issue of defining "peaceful purposes" in the context of the Outer Space Treaty. At present no distinction is made between military activities that are not specifically prohibited and other "peaceful purposes" (i.e., placing nuclear weapons or other kinds of weapons of mass destruction in orbit is prohibited). For use only within the Executive Branch at this time, it would be desirable to have a clear statement of policy by the President that we will not permit our vital intelligence satellite programs to be subjected to international controls or restraints.

Recommendation #5 - <u>That NRO and NASA should continue their efforts to utilize common techniques and services when appropriate and otherwise continue to coordinate their programs through the recently established Program Review Board. Periodically the Program Review Board should report to the Standing Committee on the results of these coordination actions.</u>

<u>Discussion:</u> While the techniques used by the civil and intelligence programs have been different, they now seem to be converging. [redacted] Thus, close and continuing coordination between NRO and NASA will be of increasing importance in the years ahead. In addition, as the capabilities of the civil systems improve, close technical and policy coordination will be required, in particular when the civil programs approach the threshold of political and technical sensitivities.

25X1 NSC

25X1 NRO

Recommendation #6 - <u>That the objectives postulated for US remote earth imagery (enumerated on pages 5 and 6) be endorsed, and together with the above options and recommendations that are approved be incorporated</u>

into new policy guidelines governing the civil and intelligence remote sensing programs and the relationship between the two.

Discussion: Rather than amend the 1966 guidelines to bring them up to date, it would be more clear cut to rescind them entirely and issue a new set of classified guidelines based on those recommendations and options that are approved, the US policy objectives proposed by the Standing Committee, and those portions of the 1966 guidelines which remain applicable.